ILLUMINATING ENGINEER

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What I think of the Bureau—I

"The most useful thing the Lighting Service Bureau is doing for the average woman," SAYS MISS CAROLINE HASLETT, C.B.E., *"is to make her 'light-conscious.'"*

MISS CAROLINE HASLETT, C.B.E.
(Director of The Electrical Association for Women)

"I feel sure that the hundreds of women who have paid a visit to the Bureau, or listened to your lectures, have all been filled with a healthy discontent with their present lighting arrangements. The average housewife does not realise the important part which electric lighting can play in the home, in bringing greater comfort and safety.

The great point about the information you give is that it is practical. A woman can learn from the Bureau how comparatively cheap electric lighting is; how, for instance, she can change the whole colour scheme of a room at the cost of no more than a few coloured lamps; how a lamp in such normally neglected places as cupboards, porches and cellars, makes for greater safety and convenience.

The average housewife endures glare and gloom in the house without realising the evils of depression, headaches and bad eyesight which they bring: your constant campaign against them cannot be too highly praised.

I have no doubt that women who have learnt of these things from the Bureau have acted upon the knowledge they have gained: again and again I have heard of improvements carried out as a direct result of the Bureau's work, and that, I think, is pretty conclusive proof that you are definitely on the right lines."

The Lighting Service Bureau is maintained by the manufacturers of the following lamps:
COSMOS CRYSELCO EDISWAN MAZDA OSRAM SIEMENS

THE ILLUMINATING ENGINEER

LIGHT LAMPS FITTINGS AND ILLUMINATION

THE JOURNAL OF GOOD LIGHTING

OIL · GAS ELECTRICITY ACETYLENE PETROL-AIR GAS ETC.

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and of
THE ASSOCIATION OF PUBLIC LIGHTING ENGINEERS
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New Illuminants and New Methods

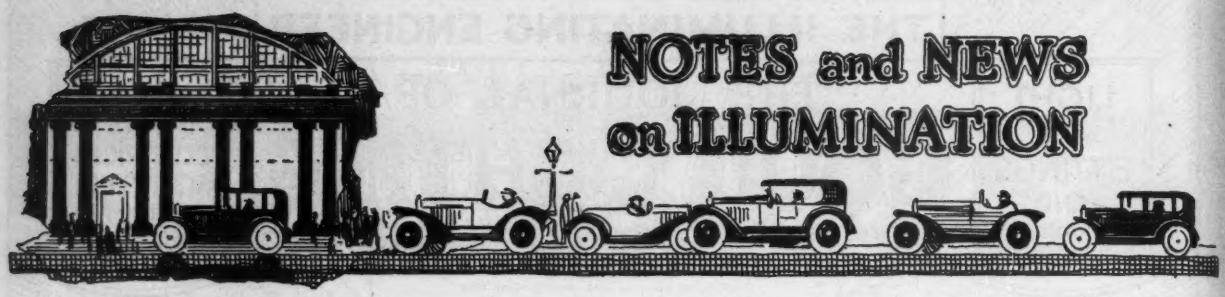
DR. HALBERTSMA'S address on "Developments in Illuminating Engineering Abroad," delivered before the Illuminating Engineering Society on March 14th (see pp. 92-96), consisted mainly of a discussion of certain topics that are exciting attention in most countries—though perhaps to a greater degree on the Continent than here. Some of these topics are involved in the use of the new electric gaseous discharge lamps, of which Mr. C. C. Paterson gave the Society such a fascinating account a few months ago. The description of the new installation of such lamps in the Watford Road (pp. 103-106) appears opportunely in this connection.

The ultimate extensive application of discharge lamps for decorative lighting effects may be taken for granted. It is also highly probable that they will be widely used for street lighting. What is less certain (though even in this direction development is more mature than is generally recognized) is their application for general interior lighting. Dr. Halbertsma referred to one possible consequence of this development—a diminution in revenue arising from the higher efficiency of the lamps, which some Continental supply undertakings seem to fear, and which has led already to appropriate modifications in tariff-schemes. Dr. Halbertsma pointed out that any apprehension on this score might well be allayed by the consideration that the luminous discharge lamps will render possible many new applications of light. But even apart from this we have little doubt that ultimately experience with the gasfilled tungsten lamp will be repeated—the coming of the new lamp will mean that not only more light but also more electricity is used than ever before.

A much more subtle and far-reaching consideration is how far the introduction of the new lamp will react on the judgment of lighting installations. In the days of comparative scarcity of light people were apt to be guided mainly by *intensity*—even when they became sufficiently sophisticated to distinguish between brightness of source and intensity of illumination. Later increased recognition of *effect*, as illustrated not merely by freedom from glare and good visibility but also pleasing appearance of the installation, has become manifest. The development of architectural lighting (to which Dr. Halbertsma also referred) has accentuated this tendency, especially in connection with the lighting of shops and places of entertainment. It is not too much to say that in many cases customers care little how much an installation costs, and still less whether or no it is "efficient," in a technical sense, provided the requisite effect and power of attraction is realized.

Even in such cases as these photometry preserves its value, if only because of its use to the designer in planning, experimenting and recording his results. But how far will this be true when coloured light, even monochromatic light, becomes available in bulk and when new factors, such as the influence of coloured light on acuteness of vision, need to be considered? Certainly in these circumstances the difficulties of heterochromatic photometry will be realized to the full. Yet we believe, with Dr. Halbertsma, that a way out of these difficulties will be found. It is possible that to photometry we may need to add other tests, such as those based on visibility and acuteness of vision. That these may have some value in connection with street lighting we allow. We hope, however, that such tests will be very carefully studied and evolved by experts; we endorse the comment made by Mr. Paterson in the course of the discussion, that reliance on the judgment of the "man in the street," or on that of a section of the population, such as motorists, is a somewhat hazardous course.

Before one can affirm with confidence in such cases "Vox Populi Vox Dei" one would like to see a more enlightened outlook on the part of the public. Although so much has been said to educate public opinion since the start of the illuminating engineering movement nearly twenty-five years ago, it remains true that many, even amongst those holding positions of authority, have little critical sense in appraising lighting installations. If it is true that illuminating engineering is becoming more of an art than a science it is the more desirable that this critical sense on the part of the public be fostered. This leads us to mention one other topic mentioned in the address, the educational work in the cause of better lighting which has been so successfully carried on in the schools of Holland. One could wish for something similar in this country. Experience of the "Safety-First" movement has shown how much can be done in the school to develop and grasp the essential principles. If all children could be brought up with an instinctive appreciation of what constitutes good lighting and a dislike of mean, unworkmanlike and unsightly methods this would be no small thing.



The Illuminating Engineering Society

Members are reminded that the **Next General Meeting** will be held in the Lecture Theatre of the Institution of Mechanical Engineers (Storey's Gate, St. James's Park, London), by kind permission of the Council of the Institution, at **6-30 p.m.**, on **April 11th,**, when a paper on **"The Lighting of Hospitals"** will be read by Mr. F. C. RAPHAEL.

The Annual General Meeting will likewise take place in the Lecture Theatre of the Institution of Mechanical Engineers at **6-30 p.m.** on **Tuesday, May 9th,** when the Report of the Council and the Accounts for the past year will be presented.

Following the transaction of formal business, a discussion on "The Principles of Directive Street Lighting" will be opened by Mr. D. Wilman.

The Illuminating Engineering Society of Australia

We have before us the Annual Report of the Illuminating Engineering Society of Australia for the past year. Their activity reflects credit on the President (Mr. E. W. Williams), the Secretary (Mr. Andrew F. O. Brown) and the Council. Although the membership is as yet of moderate dimensions (there were at the time of the issue of the report 52 members and 26 associate members), numerous meetings have been held, and papers have been read on such subjects as Show Window Lighting, The Lighting of the Commonwealth Buildings, the Sydney Harbour Bridge, and the new City Railway, Glassware, Cement Standards for Street Lighting, the Lighting of Theatres, Lighting for Night Sport, etc. A feature of the Society's work is its series of committees. Besides four standing committees devoted to programmes, finance, development, etc., eleven phases of lighting to be handled by technical committees are enumerated, namely, entertainment, floodlighting, glare and visibility fundamentals, glassware, industrial, lamps, public buildings, residences, show windows, streets, transport. It is of interest to recall that a Victorian Division, with headquarters at Melbourne, also exists, and that Mr. Turnbull's comprehensive paper on The Lighting of Sydney Bridge was repeated before that body.

The Electrical Association for Women

The winter and spring programme of the Electrical Association for Women, now nearly completed, is a varied and interesting one, and is specially noteworthy for the official opening of the new premises at 20, Regent Street, on January 31st, by the President, Lady Moir. On January 24th a visit was paid to the Building Centre, and at subsequent meetings there have been talks on various domestic applications of electricity. The eighth Annual Conference is this year to be held in Birmingham during May 3rd-5th.

The Association of Public Lighting Engineers

TENTH ANNUAL CONFERENCE IN MARGATE.

A notice has now been issued announcing the forthcoming tenth Annual Conference of the Association of Public Lighting Engineers, which is to be held in Margate during September 4th-7th. This early intimation enables the considerable number of local authorities who habitually send delegates to make provision in good time. It will, as usual, be followed by details in regard to programme, for which we understand, however, that arrangements are well advanced. Data will be presented illustrating the lighting of Margate. It is also hoped that some special demonstrations of public lighting by gas and electricity will take place. Amongst others, papers on the Lighting of Seaside Resorts, and on Conditions of Public Lighting in Paris, the Irish Free State and Bombay are in prospect. A reception, to be followed by music and dancing, will be given by the Mayor and Corporation on the opening evening, and on Tuesday members and delegates will be entertained to luncheon by the Isle of Thanet Gas Light and Coke Company. The Conference, therefore, promises to be quite as interesting as those in former years. On this occasion ladies are for the first time officially invited to attend.

The annual report is always an informative production, and members have already received a reminder of their duty to collect information (especially in regard to the effects of financial stringency). They should lose no time in commencing the collection of useful information in order that the Hon. Editor (Mr. E. J. Stewart) may receive his material by July 1st—none too soon in view of the very considerable amount of work involved in sifting such data.

Award of the Duddell Medal

The bronze medal awarded annually by the Physical Society in recognition of advances in connection with scientific instruments has this year been awarded to Professor Wolfgang Gaede, Director of the Physical Institute at Karlsruhe. Professor Gaede's name is closely linked with the design and production of high-vacuum pumps. Before 1905 the production of a relatively high vacuum was a tedious operation, though it may be recalled that the electron and X-rays were both discovered with the aid of discharge tubes exhausted by the mercury pumps then available. High vacua are required not only in research but in industry—for instance, in connection with the manufacture of electric incandescent lamps and thermionic valves, both made annually in millions. Gaede, at the age of 27, designed a simple and convenient rotary mercury pump, and he has since produced quite a variety of types, each with a definite field of utility, and all based on new principles discovered by the inventor. A recent outstanding development was the large single-stage diffusion pump designed for work at Leiden on solid helium.

TECHNICAL SECTION

COMPRISING

Transactions of The Illuminating Engineering Society and Special Articles

The Illuminating Engineering Society is not, as a body, responsible for the opinions expressed by individual authors or speakers.

Progress in Illuminating Engineering Abroad

(Proceedings at the Meeting of the Illuminating Engineering Society, held in the Lecture Theatre of the Institution of Mechanical Engineers, at 6-30 p.m., on Tuesday, March 14th, 1933.)

A MEETING of the Illuminating Engineering Society took place in the Lecture Hall of the Institution of Mechanical Engineers, on Tuesday, March 14th. Members assembled for light refreshments at 6-30 p.m., and the chair was taken by the President (Lt.-Commander Haydn T. Harrison) at 7 p.m.

The minutes of the last meeting having been taken as read, the HON. SECRETARY read out the names of applicants for membership, which were as follows:

Corporate Members:—

Austen, Colin, R. .....Staff Officer, The Gas Light and Coke Co., 35, Woburn Square, London, W.C.1

Dieterichs, W. .....Manager of Industrial Workshop and Showrooms, The Gas Light and Coke Co., 38, Cranleigh Road, Merton Park, London, S.W.19.

Hall, J. S. .....Gas Salesman, The Gas Light and Coke Co., 109, Stroud Green Road, London, N.4.

Mayo, A. F. .....Staff Officer, The Gas Light and Coke Co., Claremont, St. John's Road, Boxmoor, Herts.

Mobbs, R. R. .....Assistant and Local Manager, The Gas Light and Coke Co., 29A, Coverton Road, London, S.W.17.

Scott, N. G. .....Fittings Designer, The Gas Light and Coke Co., 47, Elmwood Road, Herne Hill, London, S.E.

Stevens, W. R. .....Illuminating Engineer, The Research Laboratories of the General Electric Co., Wembley, 39, Skinner Street, London, E.C.

Tapper, M. H. .....Staff Officer, The Gas Light and Coke Co., 15, Hayes Road, Bromley, Kent.

The names of those announced at the last meeting of the Society were read again, and these gentlemen were formally declared members of the Society.*

The Hon. Secretary also referred to one of two activities of the Society of general interest to members. He mentioned that the Technical Committee had been for some time engaged in this study of a new method of estimating the illumination necessary for various processes; it was hoped that this method would be described and illustrated during the next session. Reference was also made to the reports of the committees of the Society on the lighting of schools and libraries which had been in great demand, with the result that reprints had become necessary. The Hendon Public Library, which had been one of those visited by the committee, and had greatly aided their investigations by furnishing facilities for tests, had recently expressed a desire to reproduce the report in a forthcoming bulletin—a request to which the Council had cordially acceded.

Attention was also drawn to the forthcoming tenth Annual Conference of the Association of Public Lighting Engineers, which would be held in Margate during September 4th-7th. There were a number of members of the Illuminating Engineering Society who were also either members or associates of the A.P.I.E., and would doubtless be attending the Conference. He was asked to say, however, that others who desired to do so could attend as delegates, paying the customary fee of £2 2s.

The PRESIDENT then called upon Dr. N. A. HALBERTSMA to read his paper on "The Development of Illuminating Engineering Abroad." The paper dealt in turn with four aspects, namely, (1) fundamentals of lighting, (2) new applications of light, (3) educational problems, and (4) lighting architecture. Special reference was made to various new problems arising from the introduction of the new electric luminous discharge lamps, which afforded great variety in colour of light at a high efficiency. The lecturer enumerated various special uses for lamps of this kind, which would go far to offset any diminution in revenue of supply undertakings occasioned by their use. He also pointed out that their development would result in heterochromatic photometry becoming a subject of considerable practical importance. Dr. Halbertsma next reviewed the various methods of developing education in illuminating engineering in different countries, emphasizing the great possibilities of lectures to school children, such as had been recently organized in Holland. The final section of the address, which was illustrated by numerous lantern slides, dealt mainly with "architectural lighting," some beautiful examples of which were shown, the lecturer remarking on the great opportunities this afforded for co-operation between the architect and the illuminating engineer.

In the subsequent discussion Mr. C. C. PATERSON, Mr. C. W. SULLY, Miss CAROLINE HASLETT, Mr. W. J. JONES and Mr. J. S. DOW took part. The PRESIDENT, in summing up, proposed a very cordial vote of thanks to Dr. Halbertsma, who briefly replied to some of the points that had been raised.

In conclusion, the HON. SECRETARY announced that the NEXT MEETING would be held in the Lecture Theatre of the Institution of Mechanical Engineers on Tuesday, April 11th, when a paper on Hospital Lighting would be read by Mr. F. C. RAPHAEL.

* *Illum. Eng.*, March, 1933, page 63.

Progress in Illuminating Engineering Abroad

By Dr. ING. N. A. HALBERTSMA

(Paper read at the Meeting of the Illuminating Engineering Society, held at the Institution of Mechanical Engineers, Storey's Gate, St. James's Park, London, S.W.1, at 6-30 p.m., on Tuesday, March 14th, 1933.)

If illuminating engineering had developed exactly along the same lines in all countries an address on "Progress in Illuminating Engineering Abroad" would probably have been of little interest to the members of this distinguished Society. But, in fact, differences not necessarily fundamental, and applying rather to matters of detail, do exist and are attributable to local and personal influences.

Your Council, by inviting me to review progress abroad, has accorded me the privilege to discuss broadly the main features of the development which has taken place in other countries. I would like, however, to apply certain limits to my subject. With your permission, I will, for example, refrain from dealing with progress in the United States. I have not visited the States since the meeting of the International Illumination Commission in 1928, and I know that important developments have taken place during the last five years, which, in illuminating engineering, must certainly be considered as a long period. I hope that next winter you may have an opportunity to listen to an illuminating engineer from the States, who can give you his personal impressions of the progress in his country, which will then have reached a climax through the lighting effects at the Chicago Exhibition, 1933.

Even when the United States are excepted, the term "abroad" still covers a large field. I can only deal adequately with this by selecting some subjects, namely: (1) Fundamentals of lighting; (2) new applications of light; (3) educational problems; and (4) lighting architecture.

Fundamentals of Lighting.

The foundation of an Illuminating Engineering Society may be regarded as an event which is typical for a certain stage of the development of illuminating engineering in a country. Great Britain, in 1909, was the first European country to reach that stage. Germany soon followed (1912), but in other countries, such as France, Holland, Austria, The Argentine, Brazil and Japan, this recognition of the importance of illuminating engineering has only come during the last ten years. Although illuminating engineers as individuals have likewise achieved splendid results in other countries they do not seem to have been sufficiently numerous to enable a Society for the discussion of their problems to be established.

We must all realize, too, that the great variety of aspects of illuminating engineering, which adds so much to the interest of meetings and discussions, did not instantly come into being, but has grown gradually. After the physical and chemical research, which led to the development of better sources of light, such as the incandescent gas mantle and the metallic filament lamp, the development of efficient accessories, reflectors and diffusing glassware followed. Then we passed through a period during which much importance was attached to mathematical calculations generally based on the conception of the candle-power as the fundamental unit. These calculations were very much simplified as soon as they were based upon the flux of light. On the other hand, new complications arose when we began to realize the importance of seeing as a physiological process in the science of lighting. Probably we still will have to go a step further, and to take into account also the psychology of seeing. At any rate, we now know that the æsthetics of lighting are a subject of importance for illuminating engineering, especially for its youngest branch—lighting architecture.

A period of 25 years only has been occupied by this development, which has been as quick as it has been radical. It will be easily understood why various countries have not all reached the same step on this ladder. Countries where illuminating engineering has started ten years later may still be operating in certain fields which have been practically abandoned by others. In this respect it is interesting to note the extent to which mathematical calculations are now in favour in France and Japan, whereas in Germany and Holland work is rather concentrated upon the physiological side, especially on the influence which contrast and glare exert on our powers of "seeing."

At the end of this first quarter of a century of the growth of illuminating engineering we really seem to approach a period of stabilization. On the solid foundation of the laws of radiation, and of a logical system of photometrical units, illuminating engineering has been built up. All measurements and calculations having a physical basis, their results are accepted on the understanding that the physiological effect of radiation on the eye will bear a definite ratio to its physical energy.

We are ready to agree that under certain adverse conditions (e.g., when glare is present), one will not get the full benefit, in a visual sense, of the energy between the wavelength-limits of visible radiation. But we have hitherto applied our physiological knowledge rather to avoid unfavourable conditions for seeing, than to create new and improved conditions, viz., still better conditions than the best conditions which we thought we could realize. Amongst efforts in this direction may be mentioned the experiments with very high values of illumination which were carried out by Ruffer in Germany. Yet even with these "super-intensities" of artificial lighting we tend to arrive at limits imposed by the imperfectness of our present methods, which produce in the same source little light and much heat. This radiation of heat, which has spoilt the wax figures in the show windows of famous Paris shops, tends to set a limit to further increase of illumination, until a clever manufacturer succeeded in constructing these mannequins of a better heat-resisting material! Similar problems have been encountered in the film studios, where the possibilities of the incandescent lamp were limited by the heat projected on the actors—heat which, as well as part of the visible radiation, was entirely useless so far as photographic effect on the film is concerned.

These examples show only a few consequences of the fact that in the development of illuminating engineering the production of light through incandescence has hitherto played an exclusive part. Bearing in mind the example which nature has put before us in daylight, which is considered real "white light," it can readily be understood that the gradual transition in the colour of the light of our artificial incandescent sources towards the colour of daylight has been welcome. Heterochromatic photometry has therefore not received that consideration which it deserves, and which is necessary if we are to be prepared for the application of any

new source of light which may make its appearance, even if it is neither white nor incandescent.

This explains why, at the end of a first 25 years' period of illuminating engineering, and having proceeded through the different stages of development mentioned above, we may now be obliged to start anew and to put the building of our art and science on a larger and more solid foundation than that upon which we have trustfully relied for so long a time. The hot-cathode luminous discharge lamp has brought a variety of new problems before us. Since this lamp in various forms has emerged from the laboratory stage of development and has found practical application for various purposes, on the Continent as in Great Britain, it has not only claimed the interest of the practical illuminating engineer, but it has also thrust the problem of the measurement and evaluation of heterochromatic light again before us. It will now no longer suffice to regard heterochromatic photometry as a theoretical problem of interest only to a few specialized scientists. We need practical solutions which will be acceptable for everyday practical work, and we can no longer proceed along the same simple lines of development as answered when the colour of our light varied within limits as small as those characteristic of incandescent sources.

It is not only a question of overcoming experimental difficulties in the comparison of light of different colours—although these difficulties are great with the monochromatic, bichromatic, or even trichromatic light of these new luminous discharge lamps. We shall have to reconsider the basic idea of photometry, the principle of evaluating light.

We may well ask: What will in future determine the value of an intensity of illumination for vision, the impression of brightness, or the acuteness of vision, or even a more complicated function of the eye, e.g., the combination of acuteness of vision and eye-fatigue? The speed of vision may also play a part in certain cases, e.g., in the case of automobile traffic. There is yet another factor which we have practically neglected with our incandescent sources: the flickering of light produced by alternating current.

The main problem may be summarized as follows: Will one foot-candle of monochromatic sodium light, e.g., be equivalent to one foot-candle of white light, or shall we have to refer to tables specifying the ratio between the foot-candles for different kinds of light—a ratio which may also vary for different intensities and for different applications! Such problems are not in any way new. They have already appeared over and again, but not in such a distinct shape, nor with such a backing of practical necessity behind them.

Years ago it has been claimed for the mercury arc-lamp that its light made seeing easier for workmen in foundries and machine-shops. Nobody, however, seems to have recognized the importance of such a claim and its influence on photometry. Even with ordinary incandescent sources, if compared with a standard lamp of a more reddish colour, a change in the evaluation of luminous flux, owing to the Purkinje phenomena, has been found by Teichmüller, as soon as the intensity of illumination on the photometer-screen became less than one foot-candle. According to the distance away from the photometer of an incandescent source, and consequently upon the brightness of the photometer-screen, the candle-power of the source, calculated on a physical basis by the inverse law of squares, varied from 1 (for vision by rods) to .75 (for vision by cones). With colour-blind people much greater differences would doubtless be found. If the spectral range of colour-blindness happened to correspond exactly with the sodium line, such a perfect colour-blind person on a road lighted by sodium lamps would be no better off than a blind man. This problem is related to another old problem which had already revealed a weak point in our habit of rating illumination in foot-candles only. Should a man, who can see through one eye only, have on his bench twice the intensity of illumination which his fellow-workers have?

The importance of light in our life is from time to time emphasized and proved by the space which the daily press on the Continent, as well as in this country, is prepared to give to any radical new development. The announcements of the luminous lamp have raised the question: When will it become applicable to general lighting problems? The public indeed seems to expect that soon it will be able to take all the incandescent lamps out of the lamp-holders and replace them by the new discharge lamps! Managers of central stations have been occupied with the question whether a new lamp, having a considerably lower consumption, would be likely to upset the sound financial basis of their tariff systems. The two-part tariff, which would suffer least from such a revolution in the field of illumination, has for this reason won the sympathy even of those electricity-producers who had hitherto disliked a change in their old-fashioned flat-rate systems.

New Applications of Light.

The illuminating engineer, however, should look at this matter from a broader angle of view. Any new source of light may either render other sources obsolete, or it may open new possibilities for the application of light which did not exist before. The illuminating engineer should especially welcome the gaseous lamp for this reason. There are many fields where it is relatively unimportant to distinguish colour, but where visual acuity is of very great moment. Monochromatic light, as produced by a sodium lamp, has proved to be very useful in such cases, e.g., for lighting main roads and enabling motor-car drivers to proceed at full speed without any headlights. Lighting such roads with incandescent sources would lead to excessive cost without giving equal results, as one would neither profit by the absence of glare nor by the improved visual acuity, both of which are characteristics of the monochromatic yellow light.

The development of luminous discharge lamps has been followed closely by those who are interested in the selection of colours for signalling purposes, for road-traffic as well as for air-traffic. The number of colours available is limited, and wherever yellow is used for signalling purposes, either on motor-cars (for tail lights in Germany) or for traffic signals, it would ultimately become valueless, as soon as light of a similar colour should be adopted for the lighting of the roads themselves. Hitherto the various sources, ranging from yellow oil-flame to the blue-bulb daylight lamp for motor-cars, have been considered to give the "white light" which the regulations require for vehicles circulating on the roads. We may say that the differences in hue which exist indeed have been tolerated, but this certainly cannot be considered as a definite solution, and the whole problem of the allotment of the various colours for signalling purposes will have to be taken up again, in view of this recent development in electric illuminants. This might prove a still more difficult problem than the allotment of the various wave-length bands in broadcasting!

Another example of the necessity of taking a broad view of the value of coloured light, as compared with white light, is afforded by the growing

of plants and flowers under artificial light. When the first experiments were made with so-called white artificial light no one thought of enquiring whether radiation of this kind was best suited for the purpose. Plants had always grown and flowered in the white daylight, and because artificial light was not very different in hue it was accepted as the most suitable light. But, apart from the difference that really existed between daylight and artificial light both in regard to colour and intensity, another important distinction was entirely overlooked, viz., the strong amount of infra-red radiation produced by the artificial sources. Consequently the effects of the various kinds of radiation were not analysed separately. As a matter of fact, it might not be impossible to produce the maximum effect even by some kind of invisible radiation.

Roodenburg has studied the influence of light (radiation) on the growth of plants for years at the Agricultural University of Wageningen (Holland). Up to now he has investigated the diet of artificial light which is most suitable for plants, such as strawberries, lilies of the valley, cucumber- and melon-seedlings, tomatoes, sweet peas, gloxinias. Although the diet differs considerably for various plants with regard to the colour, intensity and periods of illumination, the red light, as produced by the hot-cathode neon lamp, in most cases was found to give far better results than any source of so-called white light. The use of neon light also proved to be much more economical. This unexpected application of a kind of light which up to now seemed to be suitable for publicity and decorative lighting only, shows that our knowledge of light is still far from perfect, and it has aroused much interest on the part of growers in those countries of the European Continent where daylight is scarce in winter.

The Measurement of Light.

At the end of this first quarter of a century of existence, illuminating engineering has at its disposal photometrical equipment entirely different from the photometer bench for determining candle-power, which was, practically speaking, the only instrument in the lighting laboratory at the beginning of this century. Everywhere the measurement of candle-power in that old-fashioned way has gradually been superseded by the measurement of the flux of light in the Ulbricht sphere. This instrument being rather bulky, its use was of necessity confined to the laboratory. In the lamp factories it has been introduced, and it is still used to a great extent. There also the measurement of light with the photo-electric cell has for the first time entirely replaced observation through the eye. The equipment for using the "electric eye" has even been made so easy to handle and so reliable that the Philips Company has introduced last year a portable photometer for the comparison of the flux of incandescent lamps. In this instrument the Ulbricht sphere, as well as a photo-electric equipment and a wattmeter, are incorporated.

In discussions of the question whether an electric lamp should be rated in watts or in lumens, the promoters of the rating in lumen have always found it a serious handicap that they could not produce an instrument with which anybody could measure anywhere the flux of a lamp, and thereby control the marking of the flux of light as easily as the wattage can be measured by a wattmeter. Professor Blondel, the father of photometry in France, once stated that all the efforts to introduce thoroughly defined official units in photometry, and all prescriptions to the industry to adhere to these, could only be half a success as long as you could not give a policeman a simple instrument by which to define the offence. The portable fluxmeter which I mentioned may be considered as the first and successful attempt to build such an instrument.

This instrument has also made it possible to show the importance of difference of flux which seriously interfere with the efficiency of a lighting installation, but which can never be determined by direct observation through the human eye.

Lighting Education.

Lighting education is a problem which has as often been discussed on the Continent as it has been in Great Britain. The need for lighting education is generally recognized; various ways and means have been provided, but there is not yet a unanimity of opinion nor uniformity in the system followed. If I may offer an explanation it would be this: Progress in illuminating engineering has been so rapid, and fundamental changes have followed each other so constantly, that a man who has been trained as an illuminating engineer five years ago may to-day seriously ask himself whether he should not start again. Architectural lighting is just a little more than five years old, yet it has radically changed our methods of interior and even of exterior illumination. I do not mean to say that our knowledge of plain interior lighting as acquired five years ago has been rendered obsolete by the development of architectural lighting, but it *has* become incomplete. The same may happen as soon as the whole range of colours of light comes to be adopted for practical illumination, either single or combined, through the introduction of gaseous discharge lamps.

The Technical University at Karlsruhe, with its Illuminating Engineering Institute, still ranks first under the centres of illuminating engineering education on the Continent. Under the able guidance of Professor Teichmüller it has succeeded in keeping pace with the development of illuminating engineering. It has earned a kind of international reputation, and has counted many foreigners among its students.

At the Technical University of Charlottenburg illuminating engineering courses are given by Pirani, Dziobek and Schneider, whose names are well-known in illuminating engineering circles. In other European countries, as, e.g., in France, certain lecture-courses for illuminating engineers have been arranged at technical universities, but their scope is not so wide that they can be considered as giving a training for a fully qualified illuminating engineer with, say, a two years' training. The number of post-graduate courses and other courses for engineers and architects who have already accomplished their technical education is very large, but they vary considerably in regard to the number of hours allotted (from 10 to 50) and the completeness of the subjects treated.

The large part played by private enterprise in this educational work is surprising. Many producers of incandescent lamps have spent considerable sums of money and much work in organizing such courses, as a service to their customers. Gradually, producers of electricity are beginning to render a similar service to their own employees and to their customers. I do not think that there is any industry on the Continent which has done so much work for the dissemination of knowledge in its own field as the lighting industry, the welding industry perhaps excepted.

Lighting service bureaux, which are now spread over all Europe, and which have even been established in overseas countries, are the real centres for

this education, which is not only limited to the technical men, but which extends also to the public as a whole.

I think that the splendid work which has been done in Germany and in Switzerland to educate the electrical contractors to get a thorough knowledge of lighting should also be mentioned. Contractors are the only advisers of the masses in lighting matters, and they may exert a very healthy influence. The lighting service bureaux can only get into contact with a limited section of the public, and they are therefore glad to have the contractors act as intermediaries.

Experience has shown, however, especially in Germany and Switzerland, that contractors become interested in large numbers when the lighting education of the public is taken up by the central stations. In the beginning many central station managers showed a distinct aversion from any steps which might raise the lighting load. Lighting load was, in their eyes, identical with peak load, and increased lighting load would certainly increase their peak load as well. Those who courageously undertook the experiment soon found that the increase in the sale of kilowatt-hours was larger than the increase of the peak load. Once this had been recognized, central stations began to undertake an active part in the organization of lighting development associations on the Continent. Herein they have initiated very useful work.

There hardly exists any technical commodity which is used so extensively as artificial light, for work and for recreation, but which is so often used in the wrong way. It is this general application of light which also justifies the proposition to include it in some way in the educational programme of public schools. Lighting may just as well claim some hours in the courses of elementary physics as other optical subjects, e.g., telescopes and binoculars. But teachers have to be taught before they can teach the children at school, and school authorities have to realize the need for such lessons.

Lighting lessons for school children were started by the Philips Lighting Service Bureau in 1926 in Brussels. The City Councillor in charge of public schools in that city having attended some demonstrations on the fundamentals of lighting, became enthusiastic and made an official recommendation to the headmasters to organize visits to that demonstration centre. From 1926 to 1932 51,450 Brussels school children from 12 to 14 years old have attended 772 lessons on the subject of lighting. In Antwerp, Liège and Luxemburg similar lessons have been organized to a smaller extent, on account of a lack of personnel.

Since 1930 lessons for school children have also been organized at Amsterdam, with the full support of the government and the municipal authorities. About 40 per cent. of the schools have availed themselves of this opportunity. From 1930 to 1932 27,860 children attended these lessons. This example is now being followed in other cities, such as Rotterdam, The Hague and Utrecht, notwithstanding the cost of the special material which has to be acquired for these lessons with demonstrations (about £85).

I need hardly emphasize the fact that a lecture on lighting suitable for adults can never be given to children. Schoolmasters have been consulted, and special teachers have been selected in order to ensure successful lectures.

If this example were followed in other countries, the next generation would become "light-conscious," and this would greatly lighten the task of lighting service bureaux and similar organizations.

Similar educational work in regard to electricity generally is also carried out in many schools in Holland. To give the coming generation a general idea of electricity and its uses is considered by many school authorities as one of the best means of preventing playing with electrical installations and the risks originating therefrom.

Ours is a technical age, and everybody has a right to be able to enjoy the resulting progress. But many people cannot do so, as they have no technical turn of mind, and as no attempts have ever been made to teach them.

The school of the future will never teach children to drive a motor-car, nor to calculate an electrical installation, but it should certainly teach the general ideas about light, electricity machines and their application.

Lighting Architecture.

As the last item of my survey I announced that I would speak about "Lighting Architecture."

When about 1925 the lighting profession had agreed on the ways in which good lighting could be produced it began to run a grave risk—that of producing lighting installations which would become as monotonous as they were efficient! For years illuminating engineers had in vain tried to come to an understanding with architects. But the architect could hardly understand the illuminating engineer and the illuminating engineer could not understand the architect. In the wonderfully efficient and perfect installations of 1925 or thereabouts there was less room than ever for an architect's ideas. The architect had to accept the fittings which the illuminating engineer had developed. The architect even had to provide the spacing which the illuminating engineer had calculated.

But suddenly the situation took a turn in a favourable direction, when "lighting architecture" began to develop. Lighting architecture has certainly not been the idea of one man, but there has been one man, Professor Teichmüller, who closely watched the development of lighting and who, at the right moment, coined that term "lighting architecture," which at the same time rendered both parties enthusiastic and interested in each other's problems.

1925, the year in which lighting architecture was born, and 1926, the year in which it was baptized, certainly are milestones in the development of illuminating engineering.

Lighting architecture is a wonderful contribution which the Continent has made to the lighting art, and the best acknowledgment of its value lies in the fact that it has so soon found its way all over the world.

In this address I cannot give you a full survey of the rapid development of lighting architecture in the various countries, but I will try and give a short résumé of the main facts which lighting architecture has achieved and will achieve:—

(1) Lighting architecture has brought together illuminating engineers and architects, thus bringing about a co-operation which had been attempted in vain for about 25 years.

(2) Lighting architecture has shown us a tremendous variety of new lines, in which we can develop lighting, both exterior and interior.

(3) Lighting architecture has largely contributed to the ideal of glareless lighting.

(4) Lighting architecture has revolutionized the fixture business, showing a way out of the labyrinth of period styles.

(5) Lighting architecture has prevented us from considering the efficiency as the only criterion of the quality of a lighting installation.

(6) Lighting architecture has even started to exert an influence upon architecture itself.

(7) Lighting architecture is going to change entirely the aspect of our cities at night.

(8) Lighting architecture will produce a satisfactory solution for the problem of matching luminous publicity with the nightly aspect of our cities.

(9) Lighting architecture has created a larger public interest in lighting.

(10) Lighting architecture has increased the sums which are allotted by the builder for the lighting installation.

Exhibitions have always afforded opportunities of presenting new developments in technical work to the public. It is not at all surprising, therefore, that lighting architecture has played a large part in the scheme of decoration of the large exhibitions which have been held since 1925. In the efforts to make these exhibitions specially attractive, funds are provided for experiments on large scale, which would otherwise remain undone, and this applies also to the use of light for decoration. Several exhibitions held on the Continent have been typical of such progress. Barcelona, Antwerp and Liège, and the Colonial Exhibition at Paris have all revealed interesting applications of lighting architecture, and Chicago will try to show something better still.

If one considers this list of ten important features of lighting architecture as a programme of the work which the lighting profession will have to do, together with the architect, during the coming years, one need not be afraid of any lack of opportunities in illuminating engineering. I am only disposed to express the doubt, whether " engineering " will then remain the right name for our art.

Discussion

Mr. C. C. PATERSON said that he had listened with rapt attention to Dr. Halbertsma's stimulating address, in which many interesting topics were discussed. He noted, for example, what had been said in regard to Ruffer's experiments. These supported the view that relatively high illuminations led to improvement in perception and action, but, as the lecturer had pointed out, it was difficult to secure very high illuminations without inconvenient radiation in the form of heat. This inability to dissociate physiological effects from visual effects was a familiar one—we experienced it when receiving the rays of the sun. It should be observed, however, that the trouble was not necessarily due to excess of heat-rays as such. A wide range of radiation created the impression of heat, and one could conceive this impression being received in a small room lighted by a high candle-power lamp, even if the latter were merely radiating light.

As Dr. Halbertsma had said, no innovation, as first presented, was quite what one hoped it would be; it was necessary to have patience and to be prepared for the effort involved in gradual perfecting of new things. Thus when the daylight lamp was first introduced it was far removed from real daylight, and indeed artificial daylight effects could not be regarded as perfect even now—one factor of consequence, he thought, was that the illumination furnished in such installations was almost invariably too low.

Dr. Halbertsma had contributed a very interesting, able and lucid survey of the difficulties in store for those who trusted to photometry. But, however formidable these difficulties might appear, he felt sure that, with courage, they would be overcome. After all, we were already engaged in dealing with sound, light and heat, and with many forms of radiation, and were therefore familiar with the complexities of measurement involved. Undoubtedly the new lamps enhanced the importance of heterochromatic photometry, and brought home to us the difficulty of appraising the value of colour in street lighting. He would like to know how installations of this type were appraised in terms of the Continental specifications. He also wondered whether Dr. Halbertsma had contrived some quantitative method of testing the opinions of motorists in regard to street-lighting installations. Personally, he felt somewhat sceptical about the possibility of weighing the views of motorists—so much depended on variations in the conditions—and he thought that conclusions on such points should be formed with reserve.

In conclusion, he wished to thank Dr. Halbertsma very warmly for his excellent paper, and the able way in which he had presented it in a foreign tongue.

Mr. C. W. SULLY remarked that the most interesting section of the address to him was that dealing with architectural lighting—a topic with which they were all much concerned just now. Dr. Halbertsma had illustrated many striking installations and novel methods of applying developed abroad. He thought that such methods of lighting ought to be further developed in this country, if only public interest could be aroused We had ample facilities for doing such work, but there seemed to be less readiness to exploit these highly original ideas. In regard to the opening section of the lecture he felt that, as a humble member of the Illuminating Engineering Society, he was only voicing the views of others when he said that it was now necessary to revise many of the ideas one had formed about illuminating engineering and return to the A B C. He did, however, gather the impression from Dr. Halbertsma's address that often things which appeared very difficult and complicated at first became easy when one had time to study them. (He might perhaps mention as a parallel the progressive familiarity of people with ordinary bridge, auction bridge and contract bridge!) In any case, he wished those who had experience of such difficulties to apply for membership in the Illuminating Engineering Society. He had been much impressed by the series of slides showing what was being done on the Continent in the way of instructing school children in the principles of illumination. This was an exceedingly important development which should be taken up throughout the world.

Miss C. HASLETT remarked that considerable time would be required to digest all the material in the paper. She would like to take the opportunity, when thanking Dr. Halbertsma for his address, also to pay tribute to the hospitality she had enjoyed when visiting the Philips Works at Eindhoven last year. She had been much struck by the wonderful methods adopted in Holland, and especially by the way in which employees were cared for. She, too, had been impressed by the reference to educational work in schools. Experience with the Safety-First movement had shown how much could be done in this way. There were many points in regard to the lighting of the home that might be emphasized; for example, the part played by bad lighting as a contributory factor in causing domestic accidents.

Mr. W. J. JONES said that he had thoroughly enjoyed listening to Dr. Halbertsma's fascinating paper. He recalled a conversation with him in a restaurant where the new luminous discharge lighting was employed. Dr. Halbertsma had suggested that in future ladies might have to dress to suit the lighting, and this was in fact done in the case of the dresses of the waitresses. He commended the study of this idea to Miss Haslett, especially in connection with the lighting of the home. Dr. Halbertsma had

touched upon many fundamental questions, which afforded material for serious thought. We, in common with experts in Germany and Holland, were coming to realize more and more the limitations of the mathematical treatment of lighting and of photometry, the results of which must be interpreted in relation to the new science of "seeing," the study of which was already being taken up by the National Illumination Committee. He wished to join with others in congratulating Dr. Halbertsma on his address, and hoped that there would be other opportunities of hearing him in the future.

Mr. J. S. Dow said that the photometric problems arising in connection with the new illuminants were certainly complex. Dr. Halbertsma had referred to the difficulties of photometry of sources yielding highly coloured light—for example the Purkinje effect—but apart from these there was the fundamental difficulty that the impression received by the eye in the case of very extensive surfaces, subtending a large angle at the eye, might be quite different from that received in looking at the small field of view of a photometer. This consideration might, he imagined, affect the judgment of the brightness of road surfaces illuminated by discharge lamps, and rendered difficult comparisons of systems involving light of widely different colour. He recalled that the L.C.C. had desired to specify a minimum illumination of 1/40th foot-candle in cinemas during the showing of films. The measurement of such a low value was somewhat difficult in the case of white light; it was exceedingly difficult when red or green light was used, as was not unusual. He had been interested in the views of streets lighted with discharge lamps, which seemed to resemble the now familiar installation at Croydon. One curious point he had observed was that the bands of brightness and darkness, not striking but still perceptible, on the roadway (Dr. Halbertsma had called it a "zebra-effect") did not seem to prejudice visibility, at least so far as the driver of a motor-car was concerned. He recalled a somewhat similar experience of Mr. P. J. Waldram when experimenting with the model street. It was found that deliberately produced, strongly contrasting stripes of brightness and darkness seemed to be excellent for revealing pedestrians on the roadway, though doubtless undesirable for other reasons. In conclusion, Mr. Dow alluded to one other curious point raised by Dr. Halbertsma—was it a fact that a man with one eye needed twice the illumination that sufficed for a person with normal sight?

The PRESIDENT, in winding up the discussion, congratulated Dr. Halbertsma on the preparation and delivery of his paper. He had, he thought, entered into quite a number of perplexing matters, which others had been rather prone to avoid. In these times it was becoming difficult to consider illuminating engineering as a science—it seemed now to be becoming more of an art. This illustrated the difficulty in conveying information to the public and to school children—to whom one could neither explain mathematical and technical procedure nor convey the feeling by which an artist was guided. He called for a very cordial vote of thanks to Dr. Halbertsma for his excellent paper. (Applause.)

Dr. N. A. HALBERTSMA, replying briefly to the discussion, dealt first with the point raised by Mr. C. C. Paterson in regard to the appraisal of installations. Everyone was aware of the difficulty of judging such installations on a purely technical basis and with the aid of calculations. His own firm, and others in Germany who were interested in the problem, were working harmoniously together, and he wished to acknowledge the assistance they had received in arranging experimental installations. In such cases they aimed at getting the impressions of the public and contriving means of determining when the visual effect was most satisfactory. One simple test was based on the reading of small type, e.g., that in Bradshaw. Installations of the sodium lamp gave favourable results judged in this way. He thought, however, that ultimately practical tests, based on the observation of large illuminated surfaces, should be made to ascertain the experience of motorist and the degree of eye-fatigue after driving for several hours. It would be, however, necessary to operate with a considerable length of road, if possible 100 miles, all lighted by the same method. The President had drawn attention to the "dualism" of illumination, the two distinct outlooks that prevailed. Naturally it was not possible to embody technical complexities in addresses to children. For the moment they aimed only at presenting simple ideas on the elements of good lighting; but in course of time it might be possible also to convey to them some feeling in regard to illumination as an art. He had been interested in Miss Haslett's remarks on the importance of good lighting in relation to the safety of the home; this was certainly a point that should not be overlooked in addresses to children. He hoped that some of those from Eindhoven, who were present at the meeting, would take this suggestion back with them and see what could be done. Mr. Jones had mentioned the restaurant in London where discharge lamps were used. He had certainly been surprised to find such an original and up-to-date installation in London, and had been struck by the effective use of coloured light. In regard to Mr. Dow's comments he could not say with certainty that a man with only one eye required *twice* the illumination that contented a man with two eyes—he felt quite confident, however, that he should receive more!

In conclusion, Dr. Halbertsma said that he did not wish to cause apprehension or concern by his forecast of the future. He felt quite satisfied that these difficulties would be met in course of time, and he knew that members of the Illuminating Engineering Society were well aware of them. He had merely aimed at a presentation of some of the chief topics of discussion on the Continent, which would doubtless occupy a leading place in their programme in the future.

Exhibition of Photo-Electric Equipment

An exhibition devoted to photo-electric cells and their applications was opened at the Science Museum on March 25th, and will remain on view for three months.

Besides exhibits showing the construction of the three main types of light-sensitive cell, some simple working experiments have been arranged to demonstrate their properties and to illustrate some of the methods of amplifying the small currents yielded by the cells under varying illuminations.

There are on exhibition a number of working models showing the use of the cells for such special purposes as the counting of small packages on a conveyor belt, in burglar alarms, and in the design of a door which is automatically opened whenever a certain beam of light is interrupted by the visitor.

Other exhibits illustrate the measurement of daylight and indoor lighting and of the density of factory smoke, and the automatic switching of street lamps. The application of the cells in the reproduction of sound from sound-films, and their use in television, are not overlooked. A complete sound-film projector is being exhibited, and demonstrations of a portable home "talkie" outfit are given in the Museum lecture theatre.

National Illumination Committee of Great Britain

(Affiliated to the International Commission on Illumination)

Report for the year 1932, presented at the Annual Special Meeting of the Committee, on Tuesday, 14th February, 1933

THE principal activity of the Committee in the early portion of the year was concerned with the consideration of the resolutions passed at the plenary meeting of the International Commission on Illumination at Cambridge, September, 1931. The British Committee had played an important part in putting forward resolutions on the various subjects under consideration by the Commission, and was able to confirm practically all the resolutions which had been provisionally agreed at Cambridge.

Most of the sub-committees of the National Illumination Committee have been active during the past year, and the accompanying report of the work of the technical committees of the Illumination Section of the British Standards Institution indicates the progress which is being made in connection with Diffusing Glassware, Light Distributions from Lighting Fittings, Aviation Lighting, Road Traffic Signals, Street Lighting and the International Vocabulary, for all of which subjects the appropriate British Standards Institution Technical Committee acts on behalf of the N.I.C.

The Lighting Education Sub-committee of the N.I.C. has been particularly active. Resolutions were passed on this subject at Cambridge calling attention to the increased importance of illumination in engineering courses, and to the desirability of the establishment in each country of a complete course of instruction in illuminating engineering. The Lighting Education Sub-committee circulated copies of these resolutions to a large number of organizations interested in technical education, and the replies from these organizations were so encouraging that arrangements were made to organize a course of lectures on the subject. The course, consisting of ten lectures, is being given at the Regent Street Polytechnic in the spring of 1933. The lectures have been arranged with the co-operation of the Illuminating Engineering Society.

The Aviation Lighting and Vocabulary Sub-committees have also been active in connection with international meetings on each of these subjects which were held at Zurich in October, 1932.

The meeting on Aviation Lighting was held on the initiative of the British Committee, who felt that while considerable progress had been made at the Cambridge meeting, development was proceeding so rapidly that it was advisable to hold a further meeting to obtain definite agreement on certain points which the British Committee wished to have discussed. The other National Committees agreed to the suggestion, and, as a result of the meeting, agreement was obtained both on the minimum number of lights which are considered necessary on aerodromes and air routes, and also on the fundamental requirements for each of these lights. The lights included airway beacons and obstruction lights, aerodrome beacons, boundary lights, landing area floodlights and illuminated wind indicators.

These agreements are subject to confirmation by National Committees at the next plenary meeting of the Commission, but there is no doubt that they represent a very considerable step forward in the direction of making night flying safer and more efficient.

The meeting dealing with the Vocabulary was held in accordance with the decision reached at the plenary meeting of the Commission at Cambridge, that a meeting of representatives of the English, German, French and Swiss National Committees should meet to draw up a vocabulary in English, French and German, to include all the terms which had been discussed at the previous plenary meetings of the Commission. As a result of the meeting, a vocabulary of about eighty terms in the three official languages of the Commission was agreed upon.

The forthcoming year should be a very busy one in preparation for the next plenary meeting of the International Commission on Illumination, to be held in Germany in the autumn of next year, and it is hoped that the British Committee will continue to play the active part it has always played at these meetings.

The Committee regrets to record the loss by death of one of its members, Mr. J. Sutcliffe, who has represented the Institution of Municipal and County Engineers on the Committee since 1927. New members appointed to the Committee during the past year are Col. H. V. Prynne, representing the General Post Office, and Mr. H. C. Weston, representing the Industrial Fatigue Research Board.

The Incorporated Municipal Electrical Association is now represented by Mr. G. Porter instead of Mr. C. G. Morley New, and the Railway Clearing House has appointed Mr. Stevens to replace Mr. Goodchild.

The National Committee again wishes to express its thanks to all those gentlemen who have served as members of its sub-committees, and who have placed so much of their time and experience at the disposal of the Committee.

K. EDGCUMBE (*Chairman*).

H. BUCKLEY (*Hon. Secretary*).

Report of Work of the Illumination Section of the British Standards Institution during the year 1932

PREPARED FOR THE N.I.C.

THE following specifications were issued during 1932:—

Revision of B.S.S. 161: Tungsten-filament electric lamps.

Revision of B.S.S. 233: Glossary of Illumination Terms.

Guide to Aerodrome Lighting.

The following work is in progress:—

Diffusing Glassware. As a result of the work carried out at the National Physical Laboratory, and by the General Electric Company's Research Laboratories, on opal glasses, the British Standards Specification No. 324 for Diffusing Glassware Illumination Fittings has been revised. The completed draft is at present in the hands of the interested organizations for comment.

British Standard Specification No. 364, Neck and Flange Dimensions of Illumination Glassware and Carriers, has also been revised, and is in the hands of the interested organizations for comment.

Light Distributions from Lighting Fittings. As it was found from a study of the paper presented at the International Illumination Congress that the German proposals in regard to this subject were very close to those in the B.S. Specification No. 398 for Symmetrical Light Distributions from Lighting Fittings, at any rate for the main classifications, efforts are being made to obtain complete agreement between the two countries. The committee is awaiting the German reply, when the specification will be reviewed. It is interesting to report that the Czechoslovakian Committee has adopted the B.S. Specification with only a few minor modifications.

Aviation Lighting. In addition to issuing the Guide to Aerodrome Lighting mentioned above, which Guide is intended for the assistance of municipalities and those responsible for deciding upon the illumination of aerodromes, the Aviation Lighting Committee has been busy this year preparing for the International Meeting which was held at Zurich recently. The recommendations of the Zurich meeting in general justify the views presented by the British Committee, as a very large portion of their recommendations has been adopted. The Committee is now busy preparing a B.S. Specification based on the Zurich resolutions.

Coloured Signal Lenses for Railway Purposes. The Committee which is dealing with this subject is making progress in the preparation of the draft specification, but at present is awaiting the results of certain work which is being carried out at the National Physical Laboratory.

Electric Signs. The Committee which is dealing with the question of electric signs was first formed to consider the draft specification submitted for comment by the Canadian Engineering Standards Association. Arising from this, the Sign Makers' Association asked for the preparation of the British Standard Specification for these signs, and work was started at the beginning of the year with which good progress is being made.

Road Traffic Control Signals. At the request of the Departmental Committee appointed by the Minister of Transport, a committee was formed to prepare a B.S. Specification for Traffic Control Signals for road purposes. This committee, which has based its work on the Recommendations prepared by the Departmental Committee, has almost completed the draft specification, which the Ministry of Transport is very anxious shall be issued as soon as possible.

Photo-electric Cells. As a result of a conference which was called by the National Physical Laboratory, a B.S. Specification is being prepared for photo-electric cells.

Street Lighting. The revision of the B.S. Specification for Street Lighting which was issued last year left in abeyance several points which needed a good deal of investigation, because this revision was required in time for the meeting of the International Illumination Commission. A further revision has therefore now been started, although it will be some time before it is issued, as a thorough investigation is being made into the outstanding points. It appears likely, however, that either two separate specifications will be issued, or else the specification will be divided into two distinct parts, one dealing with design conditions and the other with maintenance conditions.

Fittings for Double-capped Tubular Lamps. A specification has been prepared and circulated to the interested organizations for comment for Fittings for Double-capped Tubular Lamps. The comments have now all been received, and the specification should be issued within the next two or three months.

Navigation Lamps. A specification has been prepared for Ships' Navigation Lamps. It is now awaiting the comments of the interested organizations, and, when completed, will be issued as an addendum to B.S.S. 161 until that specification is re-issued, when it will be incorporated in it.

Literature on Lighting

(Abstracts of recent articles on Illumination and Photometry in the Technical Press)

Abstracts are classified under the following headings: I, Radiation and General Physics; II, Photometry; III, Sources of Light; IV, Lighting Equipment; V, Applications of Light; VI, Miscellaneous. The following, whose initials appear under the items for which they were responsible, have already assisted in the compilation of abstracts: Miss E. S. Barclay-Smith, Mr. W. Barnett, Mr. S. S. Beggs, Mr. F. J. C. Brookes, Mr. H. Buckley, Mr. L. J. Collier, Mr. H. M. Cotterill, Mr. j.S.Dow, Mr. J.Eck, Dr.S.English, Dr. T. H. Harrison, Mr. C. A. Morton, Mr. G. S. Robinson, Mr. J. M. Waldram, Mr. W. C. M. Whittle and Mr. G. H. Wilson. Abstracts cover the month preceding the date of publication. When desired by readers we will gladly endeavour to obtain copies of journals containing any articles abstracted and will supply them at cost.—ED.

(*Continued from p. 82, March*, 1933.)

I.—RADIATION AND GENERAL PHYSICS.

84. The Response of a Gasfilled Photo-electric Cell to a Short Exposure to Light. M. P. Fourmarier.

Revue Generale de l'Electricite. Vol. XXXII, No. 12, pp. 379-380, *September 24th*, 1932.

An account of experiments made with potassium and caesium cathode cells filled with neon, argon and helium. The exposure times of 500 to 1,000 micro-seconds demonstrated rapid creepage for about 100 micro-seconds when argon-filled. J. E.

85. Protection of the Eyes against Harmful Radiation. Dr. Ing. C. Maurelli.

Securitas, Vol. XX, No. 1, *pp.* 9-16.

Ocular sensitivity to light of wavelengths from ultra-violet to infra-red is discussed and illustrated by curves; certain kinds of glass are recommended for eye shields when high-temperature soldering, welding or furnace work is undertaken, or if light sources rich in ultra-violet rays are being used. J. E.

86. Plate-glass Cells. W. Pinfold.

Journal of Scientific Instruments, Vol. IX, No. 10, *p.* 331, 1932.

A strong and useful type of glass cell for liquid colour filters or for examining specimens, and which can be made quite easily and cheaply, is described. W. B.

87. Propagation Tests and the Photography of the Disturbance sent out by the Explosion of Commercial Electric Detonators. D. B. Gawthrop.

Frank. Inst. J., 214, *pp.* 647-664, *December*, 1932.

The author describes tests on various types of electric detonators, investigating the disturbance photographically. An interesting application of the Schlieren optical arrangement is given. S. S. B.

III.—SOURCES OF LIGHT.

88. The New Street Lamps. Anon.

Elect., 110, *pp.* 317-320, *March 10th*, 1933.

Comments are made on colour rendering and visibility resulting from a new street-lighting installation in North-west London that employs hot-cathode lamps. Details of the circuit are given, and photographs presented. The use of hot-cathode lamps for floodlighting is also discussed. C. A. M.

89. Bi-Post Lamps. H. G. Schiller.

Light, 2, No. 11, *p.* 29, *Mid-winter*, 1933.

A larger lamp of the bi-post type—(see Abstract No. 264 of 1932) is now available in America. This is the 115-volt 5,000-watt type. General bulb and prong dimensions are given. A 1,000-watt lamp of this type has been adopted for airway beacons. C. A. M.

90. Artificial White Light. G. Claude.

R.G.E., pp. 257-261, *February 25th*, 1933.

Methods of obtaining white light from luminous discharge tubes are briefly described. Xenon is one of the most promising gases for filling tubes in order to obtain a white light. The author discusses the effect of the pressure of the gas on the luminous efficiency of the tube, and concludes with a discussion on the technique of tube construction. W. C. M. W.

91. The Utilization of Mercury Vapour Tubes. M. Leblanc.

Lux, Vol. V, No. 10, *pp.* 147-149, *December*, 1932.

Two applications of this light-source are detailed in the photographic studio for obtaining negatives and in the reproduction department for producing positives. In the former application the distribution of energy throughout the spectrum is tabulated, and curves of ocular and emulsion sensitivity and a chronological table showing the extension spectrally of photography from 1875 up to date are presented. The effect of voltage variation on time of exposure is tabulated. J. E.

IV.—LIGHTING EQUIPMENT.

92. Electric Signs. C. Higgins.

Elect., 110, *p.* 296, *March 3rd*, 1933.

A description of types of transformers essential to the working of cold-cathode tubes is given. The high-tension cable used must be of special quality, and the housing of this cable is important. Correction of power factor to a value of 0.8 is rendered possible by means of condensers. C. A. M.

93. Getting the Economic Life Out of Street Lamps. Anon.

El. World, 101, *p.* 258, *February 25th*, 1933.

Describes a method of ensuring that lamps used for street lighting are not used for a period which exceeds the economic life of the lamp. W. C. M. W.

94. Saturation Point and Modern Fixtures. Anon.

Lighting, Vol. 23, *No.* 1, *September*, 1932.

Twenty million out of twenty-six million homes in the United States of America are already wired for electric light, and of the balance a large percentage are not at present within economical reach of a central station. To prevent stagnation, a campaign based on the superiority of modern glassware and fittings is being instituted. J. E.

95. Anti-fog Motor Vehicle Lamps. Prof. A. Amerio.

L'Illuminazione Rationale, Vol. VI, No. 2, *pp.* 36-43, *February*, 1933.

A valuable report dealing with seven makes of headlamps submitted for test. The requirements are fully discussed, the tests analysed and tabulated and conclusions are drawn. J. E.

"—use only"

Director: "What *is* the matter with our electric light these days? We seem to have less light and to pay more for current than ever before."

Manager: "I'm afraid we made the mistake of installing 'cheap' lamps at the beginning of the winter. They lose light very quickly and replacements have been unduly heavy. We shall not make the same mistake again, but in future will use only

MAZDA LAMPS

WITH THE WONDERFUL NON-SAG FILAMENT.

B T-H

3447 A

MADE IN ENGLAND ENTIRELY FROM BRITISH MATERIALS.

THE BRITISH THOMSON-HOUSTON COMPANY, LTD.

96. The Fundamental Principles of Projection apparatus. H. Schering.

Licht u. Lampe, *pp.* 29-31, *January 19th*, 1933; *pp.* 57-58, *February 2nd*, 1933; *pp.* 93-95, *February 16th*, 1933.

Both dia- and epi-projection apparatus, including in the former class film projectors, are described. An equation for determining the ratio of projected light to the total luminous flux of the source or sources and tables of efficiency of condensers, of intrinsic brilliancy of various sources, and of the influence of size of picture and objective-aperture are given. The efficiency of various combinations of light source, mirrors and condensers for dia-projection is discussed. The qualities of screens for silent and talking pictures and the limits imposed on the light-sources by working conditions are analysed. J. E.

V.—APPLICATIONS OF LIGHT.

97. Art and Technique in Illumination. A Symposium by Messrs. M. Cohu, J. Wetzel, A. Salomon, A. Vallat.

Lux, *Vol. VI*, *No.* 1, *p.* 2-8, *January*, 1933.

An endeavour to harmonize, by public expression, the views of the artist and the technician on illumination, in this instance covering the difficult subject of the estimation of an installation of artificial light, the minimum perceptible diversity, sections of cornices and the securing of evenly illuminated surfaces from point or tubular light. J. E.

98. The Solar Illumination of the Interior of Large Buildings. M. J. Arthuys.

Civil Engineering, *Vol. XXVIII*, *No.* 321, *pp.* 92-98, *March*, 1933.

An account of the "Arthel" system of trapping the light falling on roofs by mirrors and diverting it to white ceilings used as diffusers, by means of a rotated mirror following the sun's course, controlled by a photo-electric device. Installations in well-known establishments are described. J. E.

99. Daylight Distribution in Top-lighted Factories. S. S. Tjemkin.

Licht u. Lampe, *pp.* 53-55, *February 2nd*, 1933.

The author presents fourteen illustrations of typical factory buildings of economic construction with top lighting, showing by the aid of diagrams the light-distribution, the aggregate result and the effect of each top light. Conclusions are based on this data in regard to ratio of width to height, and the conditions favourable to minimum diversity factor and minimum cost of construction. J. E.

100. School Lighting. C. A. Hughes.

Elect., 110, *p.* 103, *March 3rd*, 1933.

The requirements for school lighting are discussed in detail and numerous recommendations are made. The results of a test to show the effect of conditions of illumination upon the efficiency of scholars are given. C. A. M.

101. Traffic Signalling. Dr. Ing. M. Veneziani.

Securitas, *Vol. XX*, *No.* 1, *pp.* 17-22.

The automatic traffic-control system along the Corso Venezia in Milan, which is operated by the moving vehicles in either the main or the intersecting streets or by press-button actuated by a pedestrian, is described and illustrated. Great elasticity is a feature of the system. J. E.

102. Ship Lighting. A. Rodgers.

Lighting, *Vol.* 23, *No.* 1, *September*, 1932.

Two liners, Mariposa and Monteroy, each carrying over 700 passengers in addition to dry and refrigerated freight between the United States and New Zealand, are examples of the comfort and elegance modern lighting imparts to steamship travel. A good description, with illustrations, is given. J. E.

103. Theatre Lighting. S. R. McCandless.

Lighting, *Vol.* 23, *No.* 5, *February*, 1933.

The theatre and music-hall of Radio City, New York, and their adjoining rooms, which are in the article claimed to make this installation the world's outstanding one, are described and illustrated. Four-colour decorative lighting is available in the theatre, the watt consumption in each colour being apportioned to offset the absorption of the colour. Six-watt lamps, at each seat, push-button actuated, enable the programme to be read at any time by every person. J. E.

104. Theatre Lighting. A. Radivojevic.

Die Lichttechnik, *Vol. X*, *No.* 1, *pp.* 1-5.

The Burg Theatre in Vienna, first fitted with electric light in 1882, has been recently re-equipped in a novel manner, the light-sources including incandescent lamps, mercury-vapour tubes, and a number of high-intensity arc-lamps. Mercury-vapour lamps are used for scenic lighting of clear sky-views. The arc lamps are applied to furnish high general stage illumination, the amount of light emitted being limited by iris-control. The humming from the rectified current was reduced by the use of storage batteries in parallel with the mercury-arc rectifiers and by series connection with induction coils. J. E.

105. Electric Lighting in the Farming Industry.

Licht u. Lampe, *p.* 35, *January 19th*, 1933.

An exhaustive account of the advantages of adequate lighting in the farm buildings in the interest of better conditions of health for the beasts or birds is given. Such conditions result in greater cleanliness and more regular feeding, and the differences between day and night can be largely cancelled, especially in the winter season. Greater productivity is ensured, unseen losses minimized and pilfering eliminated. J. E.

106. Electric Light on the Farm. G. Consiglio.

L'Illuminazione Razionale, *Vol. VI*, *No.* 1, *pp.* 5-11, *January*, 1933.

Tabular results of poultry farming benefitting by artificial illumination form the commencement of an illustrated article, which also embraces the beneficial effects with normal electric light, ultra-violet light, and from neon-filled luminous tubes. Soil-heating effects are illustrated as well as insect-attracting luminous traps. J. E.

107. Radiology and Electrotherapy. L. Vellard.

Revue Generale de l'Electricite, *Vol. XXXII*, *No* 11, *pp.* 341-385, *and No.* 12, *pp.* 387-399.

An unusually complete description of the equipment of the department devoted to this class of treatment in the St. Louis and Laennec Hospitals in Paris. The account is in three sections, preceded by a brief account of the evolution of electrical treatment, followed first by particulars of the radiological section of the St. Louis Hospital, and then that of a similar type but different conception at the Laennec Hospital, and finaily a detailed description of the apparatus. J. E.

108. Study of the Mode of Corrosion and of the Susceptibility to Corrosion of Metals by Means of their Light Diffusion. Francois Canac.

Comptes Rendus, 196, *pp.* 51-53, *January 3rd*, 1933.

Curves can be obtained showing the relation of the diffusion of a parallel beam of light by sheets of metal to the time of attack of a standard corrosive fluid. Two types of curves are obtained, and a theory of the methods of attack is given. The results can be used to classify metals in order of resistance to attack, and agree with classification based on other more lengthy and laborious methods. S. S. B.

Luminous Discharge Lamps on the Watford Road, Wembley

FIG. 1.—An untouched Night Photograph showing a section of the Watford Road, Wembley, illuminated by the new "Osira" Electric Discharge Lamps.

THE possibilities of the new luminous discharge lamps for street lighting are exciting considerable interest. It is but a few months since we described the novel installation of sodium lamps on the Purley Way–Croydon by-pass road.*. The inauguration of the installation of the new "Osira" discharge lamps on the Watford Road, Wembley, on March 2nd was likewise an event of outstanding interest.

It may be recalled that a series of these lamps were put into operation experimentally in East Lane, Wembley, on June 22nd, 1932. (This is stated to be the first installation in the world to employ lamps of this particular type.) At the meeting of the Illuminating Engineering Society held at the G.E.C. Research Laboratories on November 8th, another opportunity of seeing these lamps in operation was afforded, and the paper then read by the Director of the Laboratory, Mr. C. C. Paterson, contained an admirable account of their development and possibilities.†

On that occasion the use of the new lamps (the colour of light from which can be varied very greatly by selection of the luminescing gases) in coloured floodlighting was also demonstrated; of these possibilities, too, further demonstrations were given on March 2nd, both at the Laboratories and at the Hop Bine Hotel, where visitors were subsequently entertained to dinner.

A preliminary address was given by Mr. C. C. Paterson, in the course of which some lamps containing carbon dioxide and giving excellent rendering of colours, and also lamps utilizing sodium vapour, were exhibited, after which the Watford Road installation and the floodlighting demonstrations were examined. At the dinner subsequently held at the Hop Bine Hotel there was a representative gathering, the electrical industry, the Wembley U.D.C., and the Ministry of Transport being represented. Sir Hugo Hirst, who presided, justly took credit for the fact that his company had not grudged expenditure on research, even in the present hard times.

* *Illum. Eng.*, January, 1933, pages 13-14.
† *Illum. Eng.*, December, 1932, pages 308-318.

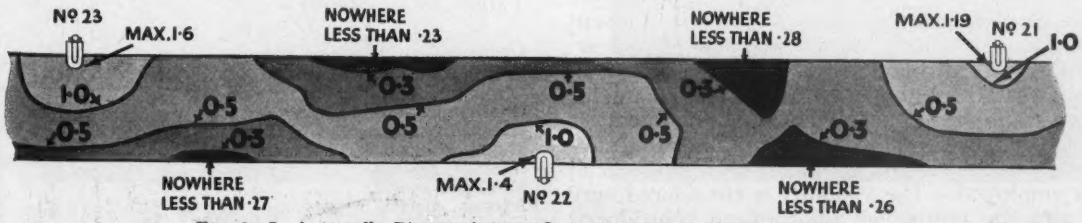


FIG. 2.—Iso-foot-candle Diagram between Posts 21 and 23 on the Watford Road.

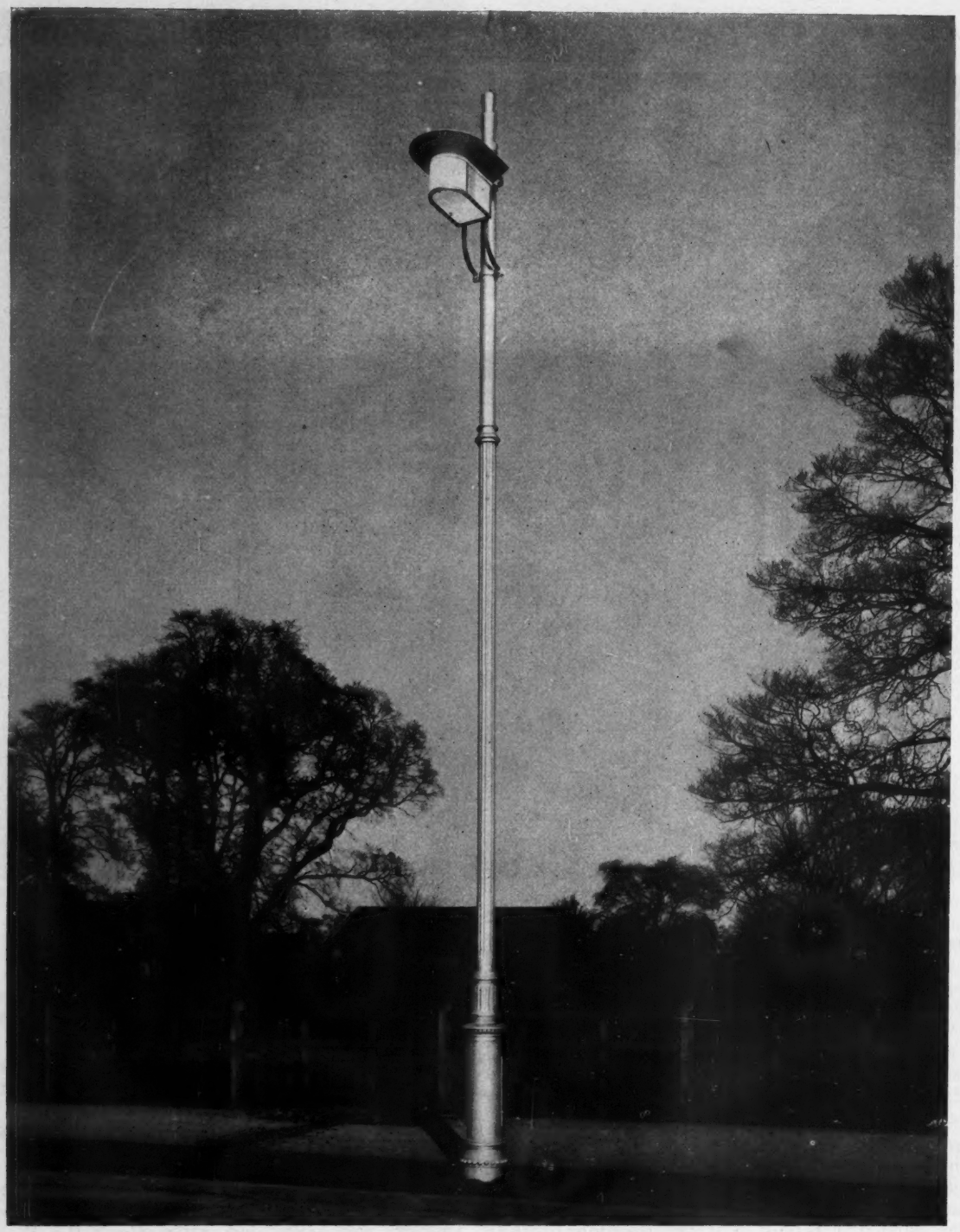


FIG. 4.—A General View of the Watford Road Unit.

THE INSTALLATION.

The new installation, which was arranged in co-operation with the Wembley Urban District Council and the North Metropolitan Electric Power Supply Company, occupies about a mile of the Watford Road, forty-six units in all being used. In the original installation in East Lane the lamps were used in clear spherical globes. For the present installation a new unit, highly original in appearance (the Watford road lantern) has been designed. The fact that the light is yielded by a column of luminous vapour, instead of an arc or filament, is in itself conducive to soft shadows and good diffusion, and this impression is enhanced by the special fittings employed. The visibility is considered very good, and the untouched photograph reproduced (Fig. 1) gives an excellent impression of the roadway when illuminated. As is indicated by the iso-foot-candle diagram (Fig. 2), a high degree of uniformity is attained. It is stated that the average diversity of brightness recorded over the 300 ft. length of road examined was 5.5 to 1.

The particulars of this installation given in Table I are of interest:—

TABLE I.

Details of Installation :—	
Width of carriageway	30 feet
Width of footway and grass verge... ...	14 ,,
Overhang of lantern over carriageway ...	Nil ,,
Height from ground to centre of light-source	25 ,,
Maximum spacing	174 ,,
Average spacing	139 ,,
Minimum spacing	117 ,,
Average spacing-height ratio	5½ to 1
Total number of units	46

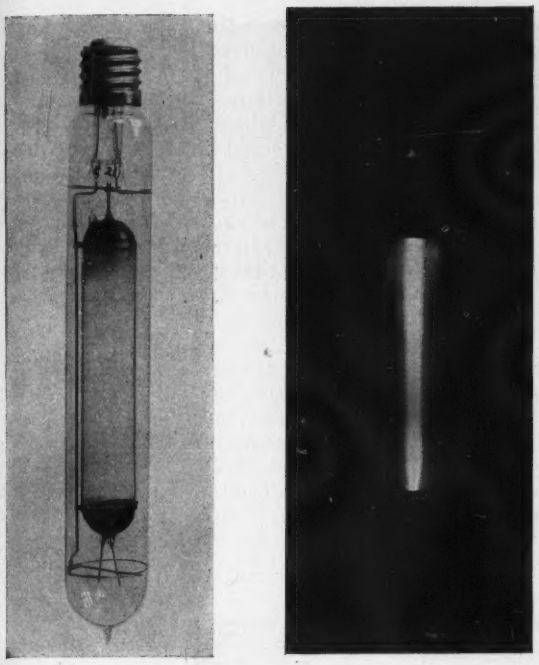


FIG. 3.—Appearance of the "Osira" Discharge Lamp when cold and when alight.

Conditions of Illumination :—

Rated mean test-point illumination on carriageway	0.27 foot-candles
Rated mean test-point illumination on footway	0.19 "
British Standard Class	"D" "
Rated average illumination on carriageway	0.75 "
Rated average illumination between boundaries of highway	0.65 "
Average diversity of illumination ... (Maximum illumination on carriageway /minimum illumination on carriageway)	5.5 to 1
Average diversity of brightness on near side of road ahead of driver	1.4 to 1

THE "OSIRA" LAMP.

In Fig. 3 the appearance of the new lamp (for which the name "Osira" has been coined), when unlighted and when in operation, is seen. The total consumption of the lamp and the necessary choke in series is 420 watts, of which 10 are lost in the choke. This wattage was selected as giving a white output approximately equal to that of a normal 1,000-watt tungsten-filament lamp. The overall efficiency is thus 2½ times that of the latter. After the lamp has been switched on the light-output increases for about three minutes; during this time the voltage across the lamp rises and the mains current falls to its normal running value of two amperes from an initial value of about three times this value. The connections are of a simple character, although the discharge lamp, having a characteristic similar to that of an arc, requires a series impedance on A.C. supplies, or an equivalent resistance on D.C. circuits. The lamp and choke are shunted by a condenser with a view to improving the power factor, which by this means can be raised to the satisfactory figure of 0.83. The new lamps have G.E.S. caps, and will thus fit into existing lamp-holders, and are at present designed to operate directly off existing A.C. supplies of 230–250 volts. The lamp starts automatically when switched on: no gear is needed to start the discharge, nor any filament transformers to heat the electrodes.

It will be seen that the construction of the lamp is very simple. It consists merely of two electrodes situated at opposite ends of a tubular lamp-bulb, which is enclosed in a vacuum jacket. Only two leads are taken to each lamp, i.e., one to each electrode. The present form of lamp is constructed to burn vertically in the "cap-up" position, but lamps to burn in the "cap-down" position can also be made.

The actual source of light is a column of luminescing vapour about 6 ins. long and ¼ in. in diameter. The colour of the light naturally depends upon the gases or metallic vapours with which the tube is filled. As already stated, "daylight" effects can be obtained by using carbon dioxide, and a very brilliant yellow light results from the use of sodium vapour. The gaseous contents of the "Osira" electric discharge lamp have not been stated, but the spectrum consists of lines in the yellow, green, blue-green and blue, with fainter lines in the yellow and orange. A certain amount of continuous spectrum is superimposed between the blue and the orange. Blues, greens and yellows illuminated by the light therefore appear as in daylight, but red colours appear brownish.

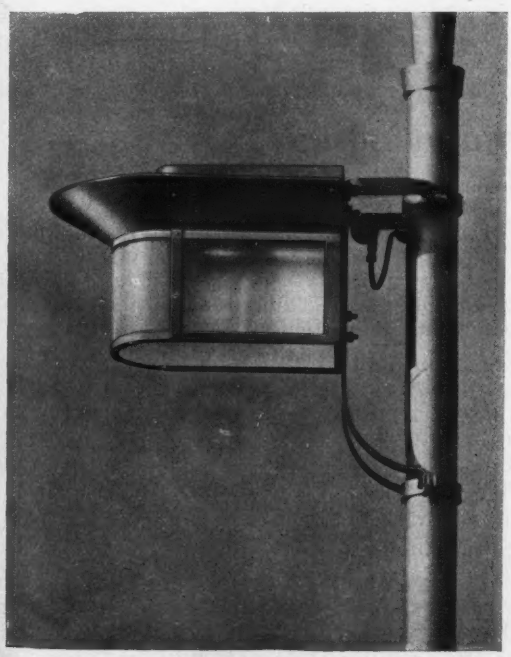


FIG. 5.—The Watford Road Lantern by day.

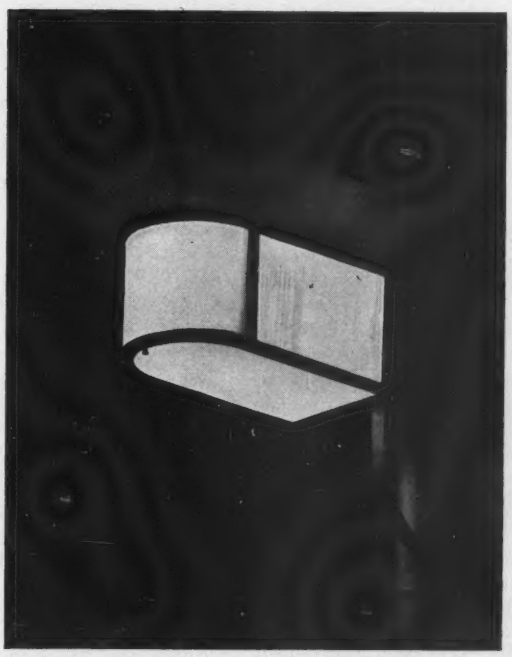


FIG. 6.—The Watford Road Lantern by night.

THE "WATFORD" ROAD LANTERNS.

The new "Watford" road lanterns are distinctly original, not only for their shape, but also for the fact that they project sideways from their posts, instead of being mounted on the top. Fig. 4 shows the general appearance of the post and lantern, and Figs. 5 and 6 the general appearance of the latter by day and by night. The columns are of steel construction. The choke and condenser are fitted in the base of the column. The decorative appearance of the lantern is enhanced by the use of diffusing glass for the bottom and curved end of the fitting. The over-reflector is of white enamel. In general "decorative" fittings involve close spacing if reasonably even illumination is to be obtained. In this case the pleasant general lighting characteristic of a diffusing lantern is combined with extensive distribution up and down the road with a view to avoiding patchy lighting at normal spacings. Adequate visibility also demands good illumination of distant vertical surfaces. This condition again renders an extensive effect desirable. In planning the distribution of light from this lantern due regard has also been paid to the effects of spread specular reflection from polished road surfaces. A special feature is the provision of a maximum unformity of brightness over the area ahead of the motorist—a higher intensity being directed away from the driver than towards him (see Fig. 2). A sharp cut-off in the light-distribution has been avoided, as this would limit the extent to which the advantages of the "spread reflection" could be used.

It will be observed also that the mere fact that one is dealing with a luminous column of light instead of an approximate point-source has a material influence on the design of the reflector as well as on the planning of the distribution of light. The vertical column of light, for example, gives a natural curve of light-distribution favourable to street lighting, and its relatively low luminosity is an advantage when specular reflection-effects from the road surface have to be considered. The reflector has been designed so far as possible to enhance these natural advantages.

FIG. 1.—A Luminous Sign for a Wine Shop. The design of this sign aptly conveys an impression of good cheer. The figures of the two vine dressers and the bunch of grapes which they support are partially illuminated by the adjacent translucent cases, on which the nature of the shop and the name of the proprietor appear. For the illumination of these cases, formed of diffusing glass, fifteen miniature lamps, each consuming fifteen watts, are used. Total power consumption, 225 watts.

New Signs in Old Surroundings

By H. KOCH (Vienna)

As a result of the rapid development of the illuminated sign in the course of the last few years, it has come about that numerous unsatisfactory installations have made their appearance—unsatisfactory in the sense that effectiveness at night has been obtained at the cost of unsightly appearance by day. As a result one finds in certain circles complaints and opposition to luminous signs—perhaps in a measure justified—on the ground that they certainly do not add to the beauty of a city. Such opposition not infrequently constitutes a serious hindrance to the wider development of publicity by means of light.

Now neither "light" nor "illumination" as such should disturb the atmosphere of an ancient city. It is only tasteless and unsightly installations that do so, and that excite objection and complaint. Just as the taste of a competent architect and his sympathetic appreciation of the charm of buildings of an earlier age can enable modern buildings to be incorporated without offence amidst the ancient architecture of an ancient city—so it is feasible to adopt the external features of a luminous sign so as to harmonize with old surroundings.

A classic example of the realization of these conditions is afforded by a new installation in the town of Innsbruck, which not only answers the requirements of the merchant in serving as an effective advertisement but also contributes to the public lighting of the streets.

The following favourable terms are granted in the case of luminous signs approved by the local authority:—

"During the period from 6 o'clock in the morning until 19 o'clock (i.e., 7 o'clock) in the evening, the signs may be lighted up or extinguished at any time according to the desire of the owner of the premises.

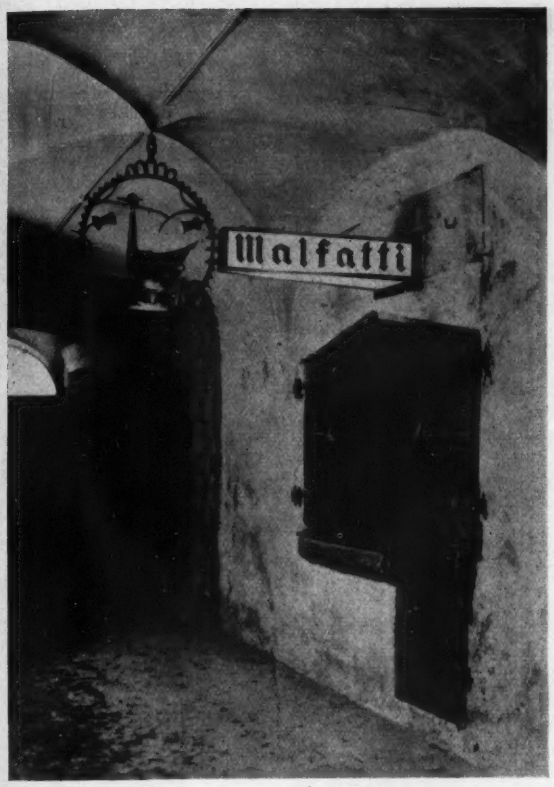


FIG. 2.—A Luminous Sign advertising a shop devoted to the sale of feathers. The design takes the form of a Goose, surrounded by a wrought-iron ring, which is illuminated by two 15-watt decorative lamps mounted in flower-shaped reflectors emerging inwards on branches from the ring. There are also two 25-watt lamps mounted within the channel-shaped reflector below. The illumination of the transparency bearing the name is effected by four 60-watt glow lamps. The total power consumption is 320 watts.

FIG. 3.—A Plumber's Sign. The original effect of this sign, highly descriptive of the nature of the business, is achieved exclusively by translucent surfaces. The flowing water is simulated very successfully by means of an opal 60-watt lamp, and the tank below, with translucent walls, by means of ten 25-watt lamps. A further series of six 25-watt lamps and twelve 5-watt 14-volt lamps in series serve to illuminate the translucent arch, on which the name of the owner of the shop appears. Total power consumption, 520 watts.

During this period the electricity consumed will be paid for in accordance with the prescribed tariff.

"During the period from 19 o'clock (7 p.m.) in the evening until 6 o'clock in the morning the switching on is effected automatically by clock control; during this period the current is supplied free of charge."

The erection and complete installation of the sign, and likewise the wiring and provision of the necessary clock control, are undertaken by the electric supply undertaking free of charge. (Cases of neglect and imperfect maintenance lead to the withdrawal of the above favourable terms of supply!)

The result of this arrangement has been eminently satisfactory for the majority of shops determined to adopt electric signs. Their design is strongly reminiscent of the wrought-iron craft-emblems of earlier times, which, by the addition of artificial light, spring once more to life.

Pleasing examples of these specially designed signs in Munich appear in Figs. 1 to 4.

It will be observed that in all cases simplicity of design is combined with originality of effect, the materials being wrought iron and diffusing glass, so that the luminous surfaces are of mild brightness. The pictures also give some idea of the "old world" surroundings in which these signs are installed.

The methods adopted in this case are naturally applicable in others where the illuminating engineer or the architect has the task of installing an effective and yet æsthetically harmonious luminous sign in proximity to an ancient building. Similar designs in wrought ironwork can usually be mounted on the façades of old buildings without giving rise to any sense of incongruity.

FIG. 4.—A Luminous Sign for a Chemist. The sign is constructed in simple form, and has an unobtrusive and yet highly effective appearance. For the illumination of the translucent case five lamps of 25 watts each are used. For the adjacent opal glass column a tubular 60-watt lamp serves both as a luminous object in the design and to complete the illumination of the poison-goblet. Total power consumption, 185 watts.

Outdoor Illumination in Rome*

THE novel, bold and extensive outdoor illumination carried out in Rome after practical experiment and adaptation has placed that city in the front rank of impressively and artistically lit places. This notable result has been achieved mainly by using light-sources placed at high elevation, a method of lighting adopted in some cities in America at the end of the nineteenth century with arc lamps before the advent of the more agreeable, efficient and steady-burning gasfilled lamp. This system as now applied in Rome has proved itself of great value for the intensive lighting of streets and open spaces, as well as for the illumination of the important or antique structures with which that city is embellished.

The spectacular illuminations in connection with the ceremonial inauguration of the Nomentana Group of Fascisti gave opportunity for demonstrations of unusual character in the Via Nomentana, a main street 40 metres wide, flanked by four- and five-storied palatial type of buildings, adjacent to which are footpaths lined on their outer sides by avenues of trees flanking the central roadway. Normal illumination of good average brightness, over the whole width, was secured by a central and two side rows of electric lamps projecting their light downwards, with their rays overlapping on the near sides of the vehicle area. This illumination, adequate for ordinary traffic, was supplemented by diffusing projectors provided with 1,000-watt lamps fixed above the copings of the buildings throwing their light on the opposite houses, brilliantly lighting them from skyline to a minimum of 2 metres above the ground level, thus securing powerful indirect lighting over the whole area whilst the eyes of pedestrians as well as vehicle drivers were entirely screened from direct rays. The combined direct and indirect illumination thus secured simulated bright daylight, and greatly enhanced the appearance and utility of this important thoroughfare. The contrast with the unilluminated sky, added to the different tints produced by the light reflected from the buildings, of slightly varying colour and reflection factor, contributed to the approval of the method which is now under consideration for permanent adoption in suitable streets. The Corso Trieste, which enters the Via Nomentana at right angles, was illuminated in a similar manner, but being without trees and only 30 metres wide, had but two rows of lower lights in addition to the projectors.

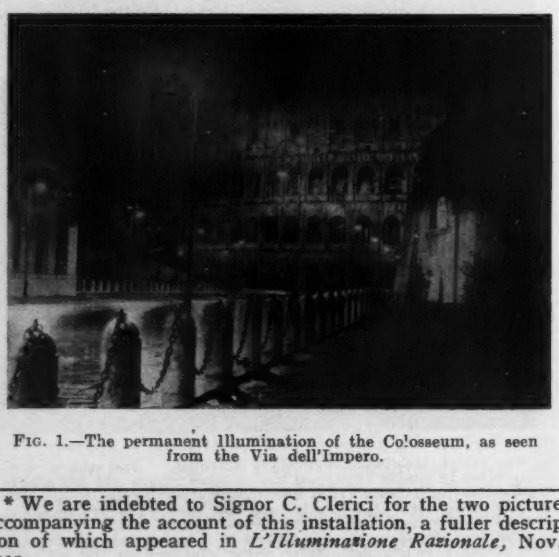


FIG. 1.—The permanent illumination of the Colosseum, as seen from the Via dell'Impero.

* We are indebted to Signor C. Clerici for the two pictures accompanying the account of this installation, a fuller description of which appeared in *L'Illuminazione Razionale*, Nov., 1932.

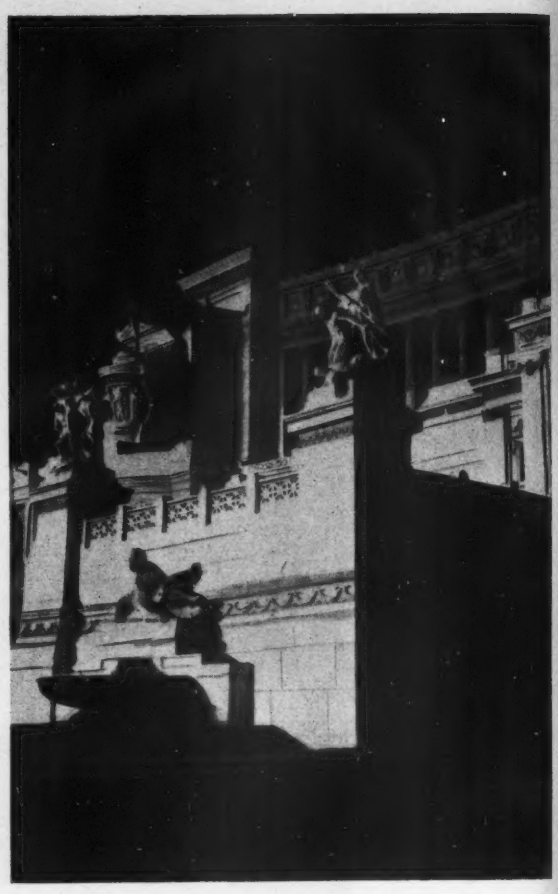


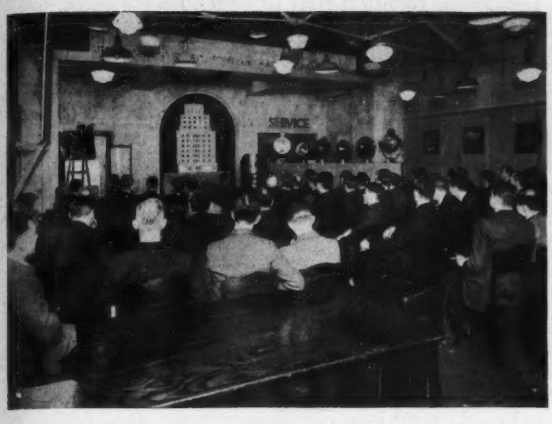
FIG. 2.—A View of the Vittoriano floodlighted.

In the vicinity of the Piazza Venezia the principle of bathing an important area in light has been permanently adopted. The convenient quadrangular tower of the palatial Assicurazioni building has been equipped with 135 diffusing projectors, the majority of which are above the cornice, with a few underneath the cornice in inconspicuous fittings harmonizing with the surroundings. Ninety-one of the projectors provided with 1,500-watt lamps throw their light on the extensive open space and illuminate the Palazzo Venezia and the impressive Vittoriano, a picture of which, taken at night, we are able to show.

The buildings are softly flooded with intense brightness from the uppermost part to just above eye-level, and from all aspects an uninterrupted view can be obtained, a result secured by the removal of the lamp columns in the foreground that hitherto disturbed the quiet view. The rest of the projectors on the tower are fitted with lamps of lower rating, and used for projecting special illumination on the Corso Umberto and for securing the completion of the circle of brilliant lighting. The Colosseum is likewise (as may be seen from our other illustration) floodlighted permanently as befits a so world-famed, antique, historic structure. The picture shows the Via Impero leading to the Colosseum, and may be taken as typical of the combined street and floodlighting applied elsewhere in the Eternal City, notably in the Via del Mare, where the Marcellus Theatre, built in 13 B.C., still remaining in good preservation, can be better seen by night than by day. Throughout the planning of the modern lighting of Rome, the preservation of restfulness and artistic result has been a prevailing consideration.

J. E.

Architects' Conferences on Lighting



A Photo taken in the ccurse of the Conference on March 15th, showing the fine Model Building used to demonstrate various schemes of floodlighting.

The Architects' Conferences held at the E.L.M.A. Lighting Service Bureau on March 1st and 15th were respectively devoted to the Lighting of Schools and to Floodlighting. The address by Mr. C. A. Hughes on the former subject emphasized the vital importance of good lighting in the interests of the vision of children. Reference was made to a survey of 28 schools in the North of England, which revealed great variety in lighting conditions—especially in the older schools. Mr. Hughes quoted extensively from the report on school lighting recently issued by the sub-committee of the Illuminating Engineering Society. The discussion of this subject was opened by Mr. T. S. Tait.

On March 15th Mr. H. Lingard gave an excellent survey of the possibilities of floodlighting, both for decorative and utilitarian purposes. Especially interesting was his analysis of the problem of floodlighting buildings, and of the alternative choice of imitating daylight appearance or creating a new "night-picture." In the later part of the lecture the variety of factors influencing floodlighting schemes was pointed out, and the nature of projectors and their adaptation to different problems discussed in detail. A feature was the use of a model three-tier building to illustrate floodlighting effects. The discussion was opened by Mr. Howard Robertson, who suggested that ultimately there should be some form of control in order to ensure a harmonious effect from adjacent displays.

Sheffield Illumination Society

On March 7th, Mr. H. H. Collett, the Superintendent of the Neepsend works of the Sheffield Gas Co., presented a paper on "Gas Works Practice" to the above organization.

Mr. Collett, in his lecture, illustrated the passage of coal through the various processes of its change into gas, tar, coke, etc., by numerous lantern slides of the plant used, and the chemical actions were fully explained. The history of the gas industry was also outlined, and it was shown how development had been speeded up by outside influence, notably the competition from electricity, and the Great War, which was responsible for a phenomenal increase in the use of the by-products.

The questions asked, after the lecture, brought to light some of the problems of pressure, and quality of gas, which confront the gas engineer to-day, and which are the subject of constant research work. Mr. J. F. Colquhoun, Public Lighting Engineer, presided.

Notes on Public Lighting

Street Lighting in Leicester.

The Annual Report of the Public Lighting Engineer in Leicester (Mr. Thomas Wilkie) is a brief and concise production. Generally speaking, the tendencies evident in reports for recent years continue. The consumption of gas for public lighting and the number of lamps in use, and likewise the average cost of gas, have slightly diminished, but the number of hours during which public lamps were lighted has increased somewhat, owing to later extinguishing in the winter months—a rather encouraging sign in these times of financial stringency! It has been decided to change from manual to automatic gas lighting. This will be a gradual process, and the first 250 lamps will be dealt with during the coming financial year.

In regard to electric lighting a material increase in the number of lamps (from 1,336 to 1,634) is recorded. This appears to be mainly due to new developments. In connection with the Town Hall Square improvement scheme three additional lamps have been installed. The ornamental lanterns have also been fitted with directional refractors, resulting in a better distribution of light. The cost of lighting (5.20d. as compared with 5.28d.) has slightly diminished.

Automatic Lighting in Sheffield.

It was on October 6th, 1819, the *Sheffield Daily Telegraph* recalls, that the first gas lamps were installed in Sheffield. The lamplighter, with his ladder, soon became a familiar feature. Now, at last, his occupation is ended. On March 10th all street lighting in Sheffield became automatically controlled. The City Lighting Engineer (Mr. J. F. Colquhoun) has been studying this development for some time, but it is only now that the 15,700 gas lamps and 4,700 electric lamps in the city will be completely subject to automatic control. It is, however, satisfactory to learn that the services of the lamplighters will be retained; they will no longer have to kindle the lamps, but will act as lamp attendants.

"The Dark Ages in Crawley."

We notice in the press a reference, under the above title, to the experience of a resident in Crawley (on the main London-Brighton Road) who has provided his own street lighting. He has erected a lamp at the entrance to his house as a protest against the inactivity of the local authority in regard to the lighting of this main road. On two sides of the lamp there is an inscription "Lights o' Crawley." The lamp costs this resident £5 to £6 a year, but he considers it well worth it. It does seem strange, as he contends, that a main road such as runs through Crawley should remain without public lamps. The incident, however, only serves to illustrate a common experience—that it is the roads which now serve to carry traffic through rural areas where the greatest need for better lighting exists. In the main streets in the centre of most towns fairly good lighting is usually provided. But in the case of the roads lighting out of the town which have changed their character and become channels of traffic, the lighting frequently has not kept pace with the altered conditions.

Aerodrome Lighting

It may be recalled that in July last some reference was made to the "Guide to Aerodrome Lighting," issued by the British Standards Institution and published with the approval of the Air Ministry. Since that date the International Commission on Illumination has met in Zurich, and has issued recommendations relating to the lighting of aerodromes and air routes. In the main, these recommendations confirm those embodied in the "Guide to Aerodrome Lighting," which may thus fairly be regarded as the prerunner of international action. The ground lights recommended by the Commission as the minimum necessary for the safe operation of aircraft by night are classified as follows:—

(*a*) Airway lighting:—
- (1) Airway beacons.
- (2) Airway obstruction lights.

(*b*) Aerodrome (Airport) lighting:—
- (1) Aerodrome (Airport) beacon.
- (2) Aerodrome (Airport) obstruction lights.
- (3) Boundary lights.
- (4) Landing area floodlights.
- (5) Illuminated wind indicator and/or landing direction lights.

Whereas the Guide dealt with aerodrome lighting only, the Zurich recommendations include references to air-route lighting, and they are in other respects more detailed. In general, however, departures from the proposals in the Guide are of a minor character. Aerodrome obstructions are now defined as those within 1,000 yards of the perimeter, instead of 500 yards; in regard to boundary lights the British Committee made certain concessions, orange, however, being retained as the standard colour. No attempt has yet been made to specify aerodrome beacons, and airway beacons are only the subject of very brief reference, owing to the diversity of practice in different countries.

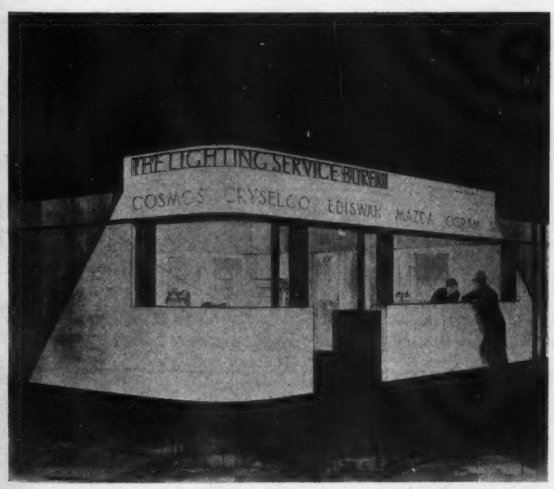
It is expected that the International Commission for Air Navigation will be asked to include these minimum requirements as an amendment to the International Convention. In the meantime the British Aviation Lighting Committee is preparing a British Standard Specification based on the Zurich recommendations.

Health Exhibition, Blackpool

We learn that the annual congress and exhibition of the Royal Sanitary Institute will take place in Blackpool during June next. Further details may be obtained from the offices of the Institute (90, Buckingham Palace Road, London, S.W.1).

We hope that the opportunity will be taken to draw attention to the importance of good lighting, both natural and artificial, in the interests of health.

The Lighting Service Bureau Exhibit at Olympia



We reproduce above a view of the proposed stand (No. 73) of the E.L.M.A. Lighting Service Bureau at the forthcoming Ideal Home Exhibition. The stand, which occupies 750 sq. ft., will be enclosed, but will be furnished with a spectacular entrance and will carry on the exterior a luminous frieze, featuring the names of constituent lamp makers in silhouette. Working exhibits illustrating lighting principles, the importance of good quality lamps, and the advantages and cheapness of electric light will be arranged, and the variety of public services and Government Departments dependent for effective operation on E.L.M.A. lamps will be illustrated pictorially.

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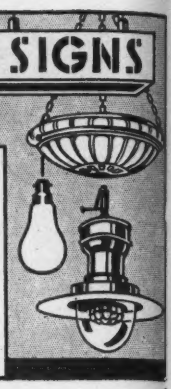
A DIRECTORY OF LIGHTING EQUIPMENT



We invite applications for spaces in this new section of the journal. Particulars of terms for each space (approx. 1 inch deep and 3½ inches wide) are given below.

These terms are equivalent to **half our ordinary advertising rates**, but not less than 12 successive monthly insertions can be accepted on this basis, and amounts are payable in advance.

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Electrical Installation Contractors. Lighting Schemes for

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For every type of GAS LIGHTING

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When you want the best!

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Underground Rivers of London

Captain W. J. Liberty (late of the City Engineer's Department of the Corporation of London) recently gave the Lunch-hour Talk at the Fulham Rotary Club, his subject being "The Hidden (Buried) Rivers of London."

The subject is a fascinating one. Probably few Londoners could trace the course of many of these now-vanished streams, though many are aware that one of them passes through a strange pipe-contrivance over Sloane Square Station on its way from the Serpentine.

The Lighting of the Trades House, Glasgow

This fine old hall has recently been lighted by fittings built up by Holophane Pagoda panels, one of which occupies a prominent position in the accompanying picture. The lighting formed an interesting problem in that not only the architecture but the unique traditions of the hall had to be considered.

These traditions go back to nearly seven centuries ago, when the fourteen chief crafts of the city combined together in order that they might hold their own with the powerful merchant guilds already in existence. They appointed a chairman, who came to be known as the "Deacon Covener"—a description which prevails at the present day. The significance of the number of crafts (fourteen) is illustrated repeatedly in the design of the hall. There are fourteen arrows in the house crest, fourteen panels in the ceiling and fourteen crafts illustrated round the frieze. Hence the fittings also embody a total of fourteen Pagoda panels, within which directing units are ingeniously assembled to give the requisite distribution of light throughout the hall.

Lighting of the Trades House, Glasgow.

A View of Derby Racing Track Floodlighted at Night.

The Derby Greyhound Racing Track

This track, which is now nearing completion, and occupies an area of 29,000 square yards, is being erected on the site of the old Derby prison. It will undoubtedly be one of the finest in the country. The illustration shows the appearance floodlighted. The total lighting load is about 180 kw. Two excellent stands have been erected on either side of the track, one of which houses a Members' Club, and serve to house clubs which are brightly illuminated by enclosed diffusing fittings of the "Silvaray" pattern, each containing a 150-watt Siemens gasfilled lamp. In all, between 50 and 60 of these units are employed. The forecourts and terraces receive illumination from elliptical reflectors of the Benjamin pattern equipped with 100-watt lamps, whilst on the track itself an even illumination of 20 foot-candles is provided. This is effected by means of "Davit" poles fitted with Benjamin R.L.M. reflectors and 1,000-watt and 1,500 watt Siemens gasfilled lamps. The lighting scheme was planned by the illuminating engineering department of Siemens Electric Lamps and Supplies Ltd.

Opening of the Seecol Theatre

The opening, by Mr. Charles B. Cochrane, of the Seecol demonstration theatre at 28 Floral Street, on March 17th, was an interesting event. This enterprise is the joint effort of the Strand Electric and Engineering Company and Hall & Dixon. Certainly it meets a want—as these companies had hitherto no adequate place for demonstrations. The effects shown on the opening day included some pleasing colour effects, whilst some examples of "trick-lighting," i.e., the imitation of the sea and of flames and fire by the projector outfit, were particularly striking. Fluorescence-effects with ultra-violet light were shown in a simple way. No doubt this item in the programme could be considerably developed.

New Catalogues

We have recently received a series of catalogues, including those from Simplex Electric Co. Ltd., under which name, it will be recalled, no less than six firms are now assembled, their varied products being marketed under the name of "Credalux." The pooling of the resources of this group naturally helps towards the prevention of overlapping and the elimination of waste; the results are already seen in the reduction of prices of certain types of units. The catalogue devoted to lighting equipment is now an imposing production.

We have also to acknowledge a new Siemens catalogue of electric light fittings, a list from the General Electric Co. Ltd. of British-made illuminating glassware (with coloured inset), and a further highly effective and original catalogue from Messrs. Troughton & Young, illustrating the new "Ultralux" fittings, which appear to have very interesting characteristics.

Contracts Closed

The following contracts are announced:—

THE EDISON SWAN ELECTRIC CO. LTD.:—

Borough of Hove; for electric lamps for the 12 months commencing April 1st next.

THE GENERAL ELECTRIC CO. LTD.:—

Belfast Corporation Tramways; part requirements for Osram and Robertson electric lamps.

Boroughs of Bootle, Hemel Hempstead, Holborn and Islington; for 12 months' supplies of Osram electric lamps.

SIEMENS ELECTRIC LAMPS AND SUPPLIES LTD.:—

Belfast City Tramways Department; for a year's supply of Siemens electric lamps and accessories.

City and County Borough of Belfast; for one year's supply of Siemens electric lamps.

Bengal Nagpur Railway Co. Ltd., India; for a large quantity of Siemens gasfilled electric lamps.

In the Holophane advertisement on the back page of the cover of our March issue the wording under the photograph, illustrating the lighting of the Turbine House at the new Battersea Power Station, should read "General Aspect of the Turbine House lighted by 1,000-watt Holophane Heavy Duty Units."

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